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## ABSTRACT

Five workplans were developed for the National Center for Education Statistics' (NCES) educational indicators program. The implementation of these workplans will be useful to both NCES staff and users of NCES data and will provide opportunities for joint working relationships among the authors, consultants, and NCES staff. The five plans call for (1) development of a handbook containing time-series data generated by NCES surveys and guidelines for use of these data in analysis; (2) preparation of a guide to interpreting indicator data that would be written for nonstatisticians and designed for inclusion in "The Condition of Education"; (3) construction of composite indexes describing the market values of the numbers and types of degrees offered at colleges and universities; (4) analysis and presentation of accreditation measures for higher education institutions; and (5) design of state reports based on the Common Core of Data, describing the changing conditions of local education agency operations. Two related reports are appended: an outline of the variables needed for monitoring the social and economic conditions in education, and a report suggesting various indicator development projects. (GDC)

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# Workplans for Developing Educational Indicators

Robert Rossi  
Kevin Gilmartin

Prepared by

**SAGE**  
STATISTICAL ANALYSIS GROUP IN EDUCATION

For the

**National  
Center for  
Education  
Statistics**

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# Workplans for Developing Educational Indicators

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April 1981

### Summary

This report, produced by SAGE staff working on development of an educational indicators program within NCES, presents five workplans to be implemented during the remainder of the SAGE base year and the planned continuation (option) year. The activities described in these workplans will produce tangible products of use to both NCES staff and users of NCES data. Moreover, implementation of the workplans will provide opportunities for joint working relationships among SAGE staff, consultants, and NCES staff. The five plans call for (1) development of a handbook containing (a) time-series data generated by NCES surveys and (b) guidelines and suggestions for use of these data in analysis; (2) preparation of a brief guide to interpreting indicator data that would be written for nonstatisticians and designed for inclusion in The Condition of Education; (3) construction of composite indexes describing the market values of the numbers and types of degrees offered at public and private colleges and universities; (4) analysis and presentation of accreditation measures for higher education institutions; and (5) design of state reports based on the Common Core of Data, describing the changing conditions of local education agency operations. Appended to this report are two SAGE products that were used in generating and evaluating the proposed indicator workplans: an outline of the variables needed for monitoring the social and economic conditions in education, prepared in draft form by Stephen Barro, and a report suggesting various indicator development projects, prepared by Abbott Ferriss.

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## Introduction

One task assigned by the National Center for Education Statistics to the 1980-1982 Statistical Analysis Group in Education was the design and development of an educational indicators program (SAGE Area I, Task 4). As understood by SAGE, the task was to be accomplished in two stages: workplans for recommended activities were first to be developed and, following their approval, the plans were to be carried out according to an integrated schedule. (The term "integrated" is used to indicate that implementation of the selected workplans was not intended to be sequential, with one plan undertaken only after another plan was completed.) This report contains the five workplans that SAGE proposes to complete during the remainder of the current contract year and during the planned option year.

Two principal considerations were taken into account as we evaluated our own ideas for projects as well as the many indicator development ideas recommendations by NCES staff, SAGE consultants, and other AIR staff working on SAGE Areas II and III. First, we wanted to undertake activities that would produce tangible products rather than recommendations drawn from state-of-the-art assessments (e.g., feasibility studies). Given this perspective, we assigned higher ratings to projects that aimed to construct indicators, analyze time-series data, or produce materials for inclusion in NCES reports. Second, we wanted to undertake activities that would contribute to NCES's role as the leading producer and reporter of educational indicator data. To give positive stimulus to the notion that NCES should engage in a continuing indicator development program, projects were more favorably viewed that would increase the accessibility of NCES-generated data to social indicators researchers and educational professionals and policymakers. We sought projects that would (1) facilitate the use of NCES-collected data by both indicators researchers and nonstatisticians, (2) develop new indicators of educational conditions based on NCES surveys, and (3) establish reporting mechanisms for indicator data that would serve state and local decisionmaking while at the same time building a solid constituency for annual data-gathering efforts. Each of the five workplans we propose in this report will produce a tangible product and increase the accessibility of NCES data to current and potential users.

Although the resources available to SAGE for use in indicator program development did constrain our selection of workplans, we do not feel that the five projects are too scaled-down or are in danger of being evaluated as mere token efforts. On the contrary, the choice of these activities was made for the reason that they make best use of the resources available to accomplish significant objectives. Work on these projects provides for the continued involvement of consultants and NCES staff in SAGE activities, leading to coauthorship arrangements when this is desirable. The titles of the five workplans and the periods of SAGE during which they would be implemented are presented on the schedule shown in Figure 1. In the report sections that follow, the five workplans are described in detail.

The processes of generating and evaluating ideas for indicator development workplans involved SAGE and NCES staff persons and five consultants: Stephen Barro, Abbott Ferriss, Denis Johnston, Robert Johnston, and Roberta Balstad Miller. Copies of the Task 4 plan of work and the The Condition of Education (Parts I and II, 1980) were distributed to task participants shortly after the contract period began. SAGE staff then met with NCES staff to discuss perceived needs and priorities for educational indicators research. Stephen Barro was asked to prepare a draft outline of the types of variables that should be monitored to assess the economic conditions of education. The scope and quality of this outline were such that it was decided, with some additions, the outline should be retitled to include social as well as economic conditions and be distributed to task participants for their use in generating indicator development proposals. The draft outline, entitled Variables for Monitoring the Economics and Social Conditions of Education, is presented in Appendix A of this report. Along with this outline, task consultants were sent summaries of several of the indicator development ideas suggested by SAGE and NCES staffs. As ideas for projects were generated they were circulated for review, and drafts of a report on indicator development ideas, authored by Abbott Ferriss, were distributed to task participants. Because this report contains many more original ideas for educational indicators research projects than could be supported by the current contract, it should be of special interest to NCES staff working to develop a continuing indicators program. This report is presented in Appendix B.

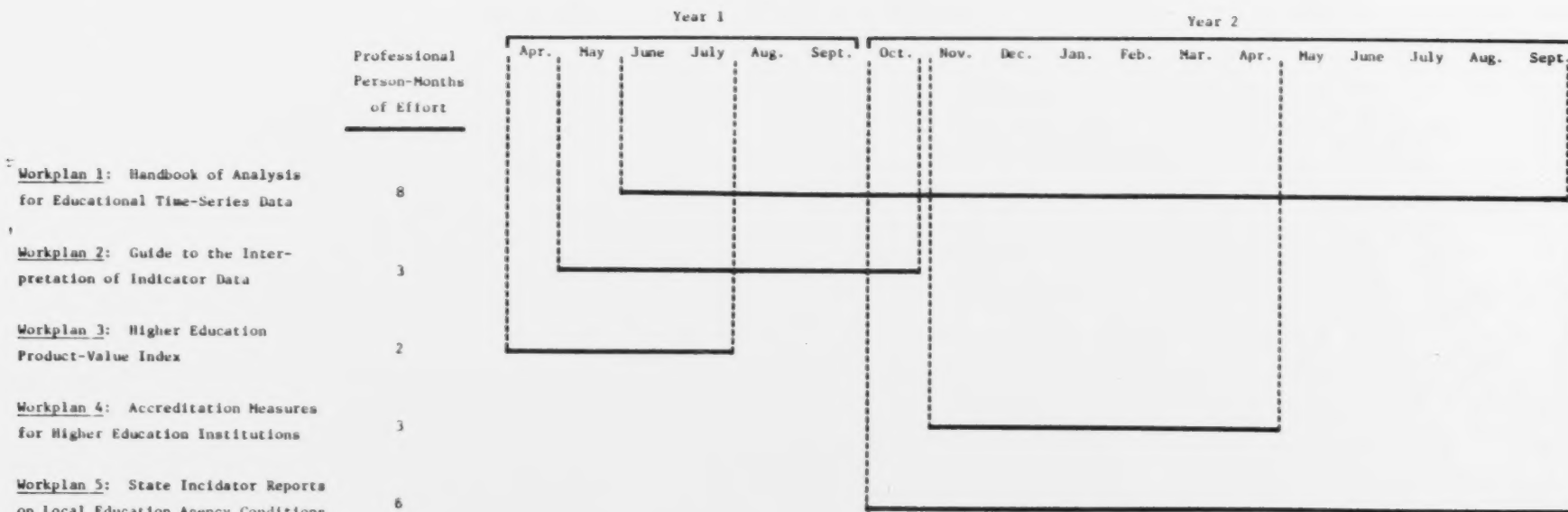


Figure 1. Schedule and Levels of effort for SAGE indicator development workplans.

We wish to acknowledge the contributions of those persons who participated either in the generation or evaluation of the proposals presented in this report:

Stephen Barro  
Independent Consultant

George Baughman  
Ohio State University

Nancy Dearman  
NCES

Abbott Ferriss  
Emory University

Denis Johnston  
Bureau of the Census

Robert Johnston  
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Donald McLaughlin  
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Roberta Miller and David Myers  
Center for Coordination of  
Research on Social Indicators  
(and all 108 respondents to the  
Social Science Research Council  
survey on improving the conditions  
of social measurement in the  
United States)

Darlene Russ-Eft  
AIR

Leslie Silverman  
NCES

Larry Suter  
NCES

## Workplan 1: Handbook of Analysis for Educational Time-Series Data

### Rationale

NCES is the major producer of time-series data in education, both through the direct collection of these data in numerous surveys and through the reporting of annual data on education originally collected by other agencies. The Digest of Education Statistics and The Condition of Education, issued annually by NCES, are prominent examples of NCES efforts to make these data available to the public. These publications and the many others issued by the Center containing detailed information on educational processes and conditions are not designed for use by analysts of time-series data, however. For time-series and several other types of quantitative analysis, the annual values of variables must be comparable over time and made available for as many years as possible. Factors that might have affected the comparability of values in a data series (e.g., changes in item-wording or survey sampling procedures) need to be extensively documented, and corrections that have been used to remove inconsistencies of this sort from the series (e.g., previous values of a series might have been recomputed to adjust for some change in the operational definition of the variable) need to be described in detail. Finally, to be useful for a wide variety of research purposes, a publication designed for use by indicators researchers should include time series that might be related in analysis to educational data series and should discuss the variety of research issues and purposes that might be addressed by multivariate analysis of these data. Although few examples exist of publications that are so specifically tailored for time-series analysis, the usefulness for indicators research of materials such as the Statistical Abstract of the United States and Historical Statistics of the United States, Colonial Times to 1970, published by the Census Bureau, and Indicators of Trends in American Education, authored by Abbott Ferriss in 1969, suggests the value of a comprehensive volume on educational time-series data.

At present, the Data Systems Branch within NCES is working to make available to users machine-readable data files containing the educational time series generated by ongoing NCES surveys. What is needed to promote

use of these data is a publication that would describe the series, discuss the comparability of series values over time, and describe ways in which these series and series generated by other surveys could be used to examine various educational issues.

### Description

We propose to develop a handbook that would describe the major time series generated by NCES surveys and would provide notes on each series concerning changes in data collection concepts and procedures. Descriptions of time series that might be analyzed together with these educational data to address various topics would also be presented, and a special listing of data series describing educational outcomes and public perceptions would be included (although not generated by NCES data collections). Each chapter in the handbook would focus on strategies for use of time-series data in examining a particular aspect of the educational system, such as changes over time in educational revenues and expenditures, facilities and staff, institutional characteristics and program offerings, enrollments and attainments, and outcomes and public perceptions. Each chapter would review the data that are available for analysis, note specific types of questions that might be addressed, present descriptions of procedures and findings from prior studies, provide examples of analytical techniques that might be used, suggest other variables to include in analysis, and refer the reader to relevant publications in the area. To the extent that this effort can be coordinated with NCES efforts to make available time-series data tapes to users, the handbook would cite which disaggregations of series can be obtained from the Data Systems Branch in machine-readable form. This handbook would be prepared in a form suitable for printing and distribution by NCES or by a commercial publisher.

### Activities

1. Lists of variables included on current NCES survey forms and on those data collection instruments of other agencies that provide data for NCES monitoring and reporting would be compiled first. Various disaggregations of a variable would be described in the handbook (e.g., time series

for total enrollments, enrollments by sex, enrollments by race, and enrollments by sex and race would all be described in the handbook). Selection of variables to present and describe in the handbook would be made jointly by SAGE and NCES staffs.

2. SAGE staff would next search for published methodology descriptions and footnotes that refer to changes in survey procedures or in the operational definitions of variables. Such changes could affect the interpretation and comparability of series values over time. Additional information on the changes in definitions or procedures would be sought from NCES staff and the staff of the other agencies working with the various surveys. Proposals for adjusting series values for changes that have occurred would be discussed with staff working on these surveys and with NCES staff involved in development of the time-series data files based on them. Whether or not series values might be adjusted to improve their comparability over time, the measurement history of each time series would be fully documented.

3. When the histories of the selected time series are compiled and methods for adjusting the series values to improve comparability over time have been documented, SAGE staff and consultants would begin to write handbook chapters describing ways of analyzing these data. Drafts of chapters would be submitted to NCES reviewers most familiar with the series that are presented and discussed in each chapter. Although our primary goal in each chapter will be to describe the basic data derived from NCES surveys and suggest ways in which these data might be used in analysis, we will also include in our discussions some of the important secondary statistics that can be derived from these basic data. For example, once the comparability of annual pupil enrollments and instructional staff counts for public and private elementary and secondary schools had been ascertained and each of these series had been described, we would point out the utility of pupil-teacher ratios for various analytic purposes.

#### Required Resources

Eight person-months of effort are budgeted for preparation of the handbook. The work will be a sizable undertaking (it is the largest in

scope of the proposed workplans) and will require frequent communications among NCES staff and SAGE staff and consultants. The finished product will be a valuable resource for indicator development activities both within and outside NCES.

## Workplan 2: Guide to the Interpretation of Indicator Data

### Rationale

Although persons who are used to working with statistical data are likely to have little difficulty interpreting tables and charts presented in indicator reports, people untrained in statistics (nonstatisticians) may find several aspects of these data displays confusing. They may not be familiar with what to look for on a graph or chart to understand the meaning of an indicator, how to interpret data from a sample, or why NCES estimates of student enrollments at various levels differ from those prepared by the Bureau of the Census. This failure in communication is particularly important because persons who are in a position to make decisions based on social reports and indicator chartbooks are quite frequently nonstatisticians. To increase the likelihood that these persons will correctly understand educational indicators, a concise guide to interpreting indicator data, written in nontechnical prose, can be prepared for inclusion in major NCES chartbooks and other statistical reports.

### Description

The guide we propose to develop would include such topics as the following: chart-reading and use of table data (e.g., suggestions of ways table data can be used to verify or to expand upon information contained in charts), measurement scales and their effects on interpretation and presentation of indicator data, possible sources of measurement error in the data, and types of adjustments made to indicator values to correct for extraneous variation (e.g., the use of constant rather than current dollars can be explained and the reader can be shown how to derive indicator values from different base years). In discussions of these topics, examples would be provided and references to selected materials for further reading by the interested reader would be made. Definitions of statistical terms and procedures commonly used in indicator reports would also be presented in the guide, possibly in the format of a glossary (which might include terms that are presently defined for the reader in appendices to The Condition of Education). Although the range of topics to be included in the guide is

broad, the discussions of the topics will be concise. When typeset, the guide should be approximately 10-15 pages in length.

### Activities

1. The first step would be to work with editors of The Condition of Education and Social Indicators III (a SAGE consultant) to make final selections of the topics to be discussed and the statistical terms and procedures to be defined. In addition to sections on the interpretation of graphic and tabular data displays, the items selected for inclusion in the guide would be ones that are frequently encountered in the presentation of indicator data and that the nonstatistician might not understand from the context of a table or chart alone.

2. Text and figures to introduce the topics and the various statistical terms and procedures would be prepared next, drawing where possible upon materials that have been developed for similar purposes (e.g., Huff, D. How to Lie with Statistics. New York: Norton, 1954). The text that is written for this guide should be reviewed by editors specializing in the presentation of technical materials to the lay reader. When final drafts of the figures and text are prepared, they would need to receive official NCES approval and be printed.

3. The guide should be included in The Condition of Education first. When tables or charts require knowledge of certain statistical concepts or procedures, references to particular discussions in the guide can be made to assist the reader. A sample of readers of The Condition of Education might be surveyed concerning the usefulness of the guide and asked for recommendations of how it could be improved. Further refinements in the guide could be made by NCES staff.

### Required Resources

Approximately three person-months of effort would be required to prepare the guide (30-50 pages typewritten, 10-15 pages typeset) for NCES approval.

### Workplan 3: Higher Education Product-Value Index

#### Rationale

In addition to providing opportunities for advanced learning, colleges and universities serve a credentialing function by certifying students for occupations through professional schools and undergraduate and graduate degree programs. Students often select the college or university they will attend as undergraduates on the basis of the major fields of study and degrees that are offered. The availability of undergraduate degrees that can reasonably be expected to lead to well-paying jobs following graduation is one factor that determines the relative attractiveness of particular higher education institutions to students and the amount of tuition they are willing to pay. Colleges offering degrees in fields that pay well (e.g., business) can charge higher tuition rates while still attracting sufficient numbers of applicants. Conversely, colleges specializing in fields with low starting salaries or high rates of unemployment among recent graduates are not a good investment for students unless they offer other services and have low tuition rates. Consequently, the mean market value of a degree from a college (e.g., its mean product value) may be a useful explanatory variable for determining why certain colleges are in distress or are financially healthy within a sector of higher education institutions.

#### Description

We propose to derive (first-approximation) product-value indexes for all public and private colleges and universities included on the longitudinal file being used in SAGE Task 2 to identify indicators of institutional viability. For each level of degree awarded by an institution (i.e., associate, bachelor's, master's, doctoral, first-professional degrees), a composite index would be developed describing the mean market value of all the degrees awarded in a particular school year. The mean market value would be weighted by the proportion of degrees awarded by the college in each field. Perceived market values of degrees in each field would be determined either by the beginning salary offers made to degree recipients in

the various fields of study or the mean salaries of workers in occupations for which certain degrees are required, and corrections could be made in these estimates for the rates of unemployment associated with the different occupations. Higher Education Product-Value Indexes (HEPVI) for institutions on the longitudinal file would then be analyzed to assess whether the ranges and types of degree programs offered by colleges and universities are associated with their being financially healthy or in distress and the extent to which colleges in distress tend to expand programs with higher market values and eliminate programs with lower market values. HEPVI measures would necessarily be rather crude, owing to the fact that institutional reputation and discrepancies among the contents and requirements of degree programs offered by different institutions would not be taken into account. Two schools that offer the same types and numbers of degree programs, for example, may be differentially attractive to students if one of the schools is known to be especially highly regarded by the science or business communities. Similarly, students may prefer to attend institutions that offer degrees in fields with many job opportunities but impose only minimal coursework requirements. For research purposes, the indicators that are developed would be adequate. HEPVI estimates would permit examination of the relationships between program offerings at institutions and the financial health of these institutions. However, HEPVI estimates would not be suitable for evaluating or ranking individual institutions, although the measures when reported for types of institutions (e.g., Title III institutions) would be of interest to both practitioners and policymakers in higher education. For this reason, the SAGE technical report that would be issued describing development of HEPVI and the relation over time of HEPVI estimates to the viability of higher education institutions would be written without identifying the HEPVI values for individual institutions.

#### Activities

1. At the onset of this task, data on beginning monthly salary offers made to graduates at all degree levels would be obtained from the College Placement Council. The CPC Salary Survey, which provides these data and have been conducted for over 20 years, is based on a representative sample of 161 colleges and universities whose graduates' starting salary offers

are obtained from the 184 placement offices serving the schools and from the graduates themselves via self-reporting. A broad range of job types is surveyed, although teaching is excluded. The June CPC report includes mean salary offers based on more than 65,000 job offers at the bachelor's level, 8,000 offers at the master's level, and 1,000 offers at the doctoral level. For each degree level, mean salary estimates are derived for various curriculum areas: 24 areas for bachelor's degrees, 19 areas for master's degrees, and eight areas for doctoral degrees. Although degrees in the humanities and social sciences, engineering, business and management sciences, and life and physical sciences are covered in the surveys of offers made to bachelor's and master's degree recipients, only science and engineering fields are surveyed for doctoral degree recipients. (CPC does not report earnings data for first-professional degree recipients.) Because it has been more common in past years for science, business, and engineering graduates to receive job offers by the time of the June CPC Salary Survey as compared to liberal arts graduates, a special summer survey is now conducted that attempts to provide better representation of offers to humanities and social science degree recipients. Data from both the June and the summer CPC Salary Surveys would therefore be obtained for HEPVI development.

2. Earnings data would also be obtained from the NCES biennial survey of Recent College Graduates (RCG). Although earnings estimates are available only for bachelor's and master's degree recipients, RCG does provide estimates of the unemployment rates associated with various fields of study. Moreover, RCG oversamples institutions offering education and teaching degrees and therefore can provide information on the starting salaries of degree-holders who enter the teaching profession in the year after their graduation.

3. Additional salary and unemployment data would be obtained from the most current NSF-sponsored surveys of the labor force participation of scientists and engineers. For example, the unpublished report by Betty Vetter for NSF entitled Labor Force Participation of Women Trained in Science and Engineering and Factors Affecting Their Participation (Grant No. SRS77-19575, June 1979) presents 1978 median salaries for male and

female science and engineering degree recipients at all levels, and the NSF report entitled Characteristics of Doctoral Scientists and Engineers in the United States: 1977 (NSF 79-306, 1977) provides salary and unemployment estimates for doctoral degree recipients in science and engineering following their college or university graduation. These data would be compared to the salary estimates available from the CPC Salary Survey and the RCG survey to determine discrepancies among the estimates for further checking and to derive unemployment estimates for use in correcting HEPVI values for doctoral degree recipients in science and engineering fields.

4. Finally, estimates of mean starting salaries and mean salaries for experienced professionals would be obtained from the Occupational Outlook Handbook, 1980-81 edition. Information on starting salaries for selected occupations obtained from this handbook can be compared to those estimates derived from other sources to assess consistency. More importantly, this handbook will provide the most up-to-date earnings estimates for professional degree-holders--estimates not available from the sources mentioned in 1-3 above.

5. Having determined one or more earnings measures for all the various types of degrees included in the HEGIS assessment of degrees awarded, HEPVI measures would be derived for four-year public and private institutions based on the numbers of degrees awarded in major fields of study at each institution. Numbers of degrees awarded by field and level are available from HEGIS, and HEPVI values would be constructed for those institutions appearing on the longitudinal file being used in SAGE Task 2 (virtually all accredited colleges in the country). HEPVI values for these institutions would be computed for the school years 1974-75 to 1978-79 and would be converted to constant dollars.

6. Once HEPVI measures are added to the longitudinal file, various analyses would be performed to determine whether changes in HEPVI values are related to changes in the financial health, or viability, of higher educational institutions. Various indicators based on HEPVI would be computed for each college (e.g., mean HEPVI divided by tuition and fee rates, total HEPVI per FTE student, total HEPVI per full-time faculty member,

total HEPVI divided by educational and general expenditures, total HEPVI divided by tuition revenues minus total expenditures for student scholarships and loans). These indicators would be validated by comparing the values for colleges that closed, defaulted on a federal loan, or in some other way were in distress to the values for the rest of the institutions in each sector. A technical report on the utility and interpretation of HEPVI for analyzing the status of higher educational institutions would be prepared and submitted.

#### Required Resources

Approximately two person-months of effort would be required to derive product-value indexes (HEPVI), to add these measures to institutional records on the HEGIS longitudinal file (SAGE Task 2) for analysis, and to prepare a SAGE technical report on the development and interpretation of HEPVI values.

#### Workplan 4: Accreditation Measures for Higher Education Institutions

##### Rationale

The recent nationwide survey conducted by the Social Science Research Council Center for Coordination of Research on Social Indicators was designed to elicit suggestions from experts on ways to improve social measurement in the United States. One general theme that emerged from those survey responses concerned with improving measurement in education was that indicators are needed to assess the quality of educational programs. Measures of the accreditation status of colleges and universities provide information on the general standing or quality of these institutions. For this reason, the accreditation status of higher education institutions may serve as a nonfinancial indicator of whether they meet minimal standards for educational quality overall or in particular programs (i.e., whether they are viable). Although the Higher Education General Information Survey (HEGIS) annually reports the accreditation status of colleges as determined by the various types of accrediting agencies, no attempt has been made to utilize these data in developing educational indicators. Analyses are needed to determine (1) the relationship between accreditation status and institutional viability for colleges and universities, (2) the characteristics of colleges accredited or not accredited by various types of accrediting agencies, and (3) the characteristics of students attending nonaccredited colleges (and possibly receiving substandard educations).

##### Description

We propose to add HEGIS accreditation data to the longitudinal file being developed in SAGE Task 2 and to examine differences in accreditation status between viable institutions and those found to be in distress. Moreover, we propose to work with NCES staff in the Data Systems Branch to use the most recent HEGIS data to provide an up-to-date tabulation of the institutional and student-body characteristics of colleges receiving accreditation from the various types of responsible agencies. A SAGE technical report would be written describing the results of these analyses and setting forth recommendations for reporting accreditation indicators based on

future HEGIS surveys. Tabulations based on recent HEGIS data could be prepared in a format suitable for publication in The Condition of Education, 1982 edition.

### Activities

1. The first task would be to obtain accreditation data from HEGIS Institutional Characteristics files for the school years 1975-1981 and to add these data to the Task 2 longitudinal data file. HEGIS reports accreditation status in terms of five categories (full accreditation, accreditation through parent institution, provisional accreditation, four-year institution with two-year college accreditation, and candidate for accreditation) for all major accrediting agencies. There are four types of accrediting agencies: regional associations of colleges and universities, professional associations or special professional accrediting commissions, state education agencies, and state universities. (Data for nonaccredited institutions are not collected by HEGIS unless at least three accredited institutions regularly accept transfer credits from these institutions.) Once added to the longitudinal file, data describing accreditation status would be compared over time for colleges determined by previous Task 2 analyses to be either viable or in distress. Various indicators of accreditation status and change would be developed separately by institutional sector (or Carnegie or NCHEMS code), region of the country, and affiliation and validated by comparing colleges in distress to the rest of the population in each sector. The indicators would include (1) various rankings of accreditation status (taking into account the standards employed by the accrediting agencies where possible); (2) indicators of accreditation deficiencies (which would depend on what accreditations are appropriate for a particular institution, which would in turn depend on the type of institution, its location, and the types of programs it offers); and (3) indicators of change in accreditation (new accreditations, upgrading of status by an accrediting agency, or revoking of a previous accreditation). Analyses would be performed to determine the numbers and characteristics of students attending colleges with deficient accreditations to determine whether certain groups of students appear not to have equal access to quality education (or at least to education that has been certified as meeting certain minimal

standards). [Note: Until accreditation data are added to the Task 2 longitudinal file, we cannot be certain whether all the analyses proposed would be feasible (e.g., the great majority of institutions in the HEGIS reporting system might have been fully or provisionally accredited during the period 1975-1981). However, if it were the case that too few schools either had changed accreditation status or were other than fully or provisionally accredited during the period described by the data, analyses would be modified accordingly. For example, although the types of agencies and their standards for awarding accreditations to universities and colleges in distress could still be compared to those agencies accrediting financially healthy schools, we might also explore whether composite indicators of accreditation status could be developed for selected institutions within the different sectors based on the accredited statuses of their major study areas and professional schools. Data for these analyses could be obtained directly from the various accrediting agencies, and the composite indexes could be included along with the analyses of accreditation status based on the Task 2 longitudinal file in the planned SAGE technical report.]

2. The second step would be to draft a SAGE technical report describing the results of the analyses described in Step 1 and recommending strategies for the periodic reporting of accreditation measures based on HEGIS data. Tables and charts based on recent HEGIS accreditation data could also be prepared at this time for inclusion in The Condition of Education, 1982 edition.

#### Required Resources

Approximately three person-months are required to carry out analyses related to the development of educational indicators from HEGIS accreditation data.

## Workplan 5: State Indicator Reports on Local Education Agency Conditions

### Rationale

NCES depends upon state and local education agencies and public schools to provide annual information for its Common Core of Data information system. Each of the nine survey forms corresponding to the major parts of the CCD begins with the statement that, while responses are not required, "[your] cooperation is needed to make the results of this survey comprehensive, accurate, and timely." In past years, NCES has sought to reinforce the cooperation of these state and local educational entities through the publication of statistical summaries of educational conditions in the 50 states and in the 20 largest cities in the United States (e.g., Statistics of Public Elementary and Secondary Schools). Because shrinking educational resources at the state and local levels may increase the difficulties associated with collecting and reporting accurate information for the CCD, additional effort should be made by NCES to (1) demonstrate to CCD participants the usefulness of the statistical reports generated by this data system and (2) assess the relative values of CCD survey items for local and state-level decisionmaking. This workplan proposes developing a series of individualized state reports that summarize the status of local education agency operations within states and compare the status of these operations to various standards (e.g., the status in previous years, the current status in similar states, target or goal values, or national averages) that can increase the usefulness of the information for state- and local-level decisionmaking.

### Description

We propose to work with NCES staff directing the CCD system, the Committee on Evaluation and Information Services (CEIS) of the Council of Chief State School Officers (CCSSO), and the Council of the Great Cities Schools (CGCS) to determine the types of indicators based on CCD surveys and selected other data sources (e.g., the Census of Local Governments) that would be most useful to state and local education agency personnel.

SAGE staff would then develop prototype indicators and various comparison values based on the most recent data from these sources. Norms based on national averages for an indicator are easiest to compute, although they may be the least informative. Additional approaches to constructing comparison measures would be tried: standards based on past indicator values for states (e.g., peak values during the previous five years), on current indicator values for comparable states (e.g., determined using cluster analysis), and on target or goal values determined during interviews with state schools staffs. Working together with NCES staff, CEIS, and CGCS representatives, SAGE staff would select 15-20 indicators and associated comparison measures to present in individualized state reports. Graphic displays for these indicators would be prepared and brief descriptive text would be included with these displays in the state reports. In addition to the state reports, a SAGE technical report would be submitted to NCES describing the procedures used to develop indicators and standards, the problems that were encountered and how they were resolved, and SAGE recommendations concerning how the individualized reporting approach might be continued using existing CCD resources.

### Activities

1. The first step in creating individual indicator reports for the states is to select the data elements from which indicators and comparison values are to be derived. SAGE staff are interested in working closely with NCES staff overseeing operation of the CCD system and with CEIS and CGCS representatives to select these data elements. For this reason, the start-date for activities proposed in this workplan was selected to shortly precede the annual meeting of the chief state school officers in November 1981. At this meeting, the state reports concept could be presented by NCES and first attempts to build a constituency to assist in the effort could be made. Following this meeting, SAGE staff would conduct interviews with CEIS and CGCS representatives. These interviews would concern critical decisions that might be informed by indicators based on the CCD and on other relevant data sources. For example, the following items might be explored during discussions with state and local education officials:

- information required for monitoring the school system at both district and state levels;
- information needed to anticipate changes in the educational system or its components;
- information relevant to planning for the future (e.g., 3-5 years ahead);
- specific standards or criteria that are essential for assessing changes in school characteristics and operations from one year to the next; and
- the conceptual frameworks or paradigms that are used by school officials to interpret educational data for their districts and states.

In addition to the usefulness of a statistic or indicator for state- and local-level decisionmaking (the key criterion for selection), CCD features explored during Task 2d of the previous AIR SAGE, such as response rates, timeliness of response (which can affect the values recorded for a state on CCD computer files), and the comparability of procedures used in different states to obtain the information (which may affect the choice of comparison measures for an indicator), would be used in the selection process. These same criteria would also be applied in evaluating data sources other than CCD (from which measures would be derived to place the CCD information in context).

2. Following the selection of data elements and the indicators to be developed from them, SAGE staff would work with NCES staff in the Data Systems Branch to obtain and process data files for the 1979-80 CCD surveys (or the 1980-81 data files if the data are available by November 1981). SAGE staff would also collect the required data from other existing sources (e.g., the 1980 Census) at this time.

3. Prototype indicators derived from the data elements selected in Step 1 would next be developed. For each of these indicators, various comparison measures would also be derived. For example, cluster analysis might be used to identify comparable groups of states (based on similarity of demographic characteristics, major industries, methods of state support for local education, and so on), and the indicator values for any one state

could then be compared to the mean indicator values for that state's reference group. National averages for all indicators would also be computed, although data availability and comparability for past years would determine whether peak indicator values for individual states or for groupings of comparable states could be used as indicator standards. (AIR staff began examination of CCD across-year comparability during work on Task 2d of the previous SAGE and recommended various procedures for relational and longitudinal editing of CCD Parts VI and VI-A.) Finally, target or goal values for individual indicators, determined during SAGE interviews with CEIS and CGCS representatives, might be used to assess current status. The prototype indicators and proposed indicator comparison measures would then be reviewed together with NCES staff and with CEIS and CGCS representatives.

4. Graphic displays would be prepared next for those indicators and comparison measures that are approved. Descriptive text would also be prepared, highlighting important local education agency conditions within states and indicating the status of these conditions relative to national and comparison-group averages, previous measures of educational system performance, and target or goal values for system performance by state. Following review by NCES staff, the state reports would be prepared for printing and dissemination.

5. A SAGE technical report would be prepared concerning the development of these reports and recommendations for their continued production by NCES staff based on future CCD surveys (e.g., the software specifications for producing state reports by computer). Methods would be discussed for producing large numbers of "individualized" reports at reasonable cost, for example the use of computer graphics, the development of text that can be easily modified to fit the circumstances, the use of a word processor to insert specific indicator values into general purpose text, and inexpensive methods for printing professional-looking reports when the number of copies of each report printed is relatively low.

### Required Resources

Six person-months of effort have been estimated for completion of this workplan. This resource estimate is based on reports of the readiness of CCD survey information for analysis. Should problems be encountered in the use of these data, a revised workplan would be submitted to NCES at the earliest possible time.

### Introductory Note for Appendices A and B

The materials presented in the appendices that follow were prepared as part of the process of generating ideas for educational indicator workplans. To prevent against a too-narrow or completely data-driven approach to designing workplans, Stephen Barro was asked to prepare an extensive outline of the types of variables that might be monitored to assess the economic conditions of education. Because it included many variables related to monitoring the social conditions of education, variables that would need to be analyzed together with the economic variables identified, the outline was retitled, expanded in some areas to include other variables descriptive of the social conditions of education, and circulated among SAGE Task 4 participants to stimulate their thinking concerning what indicator development tasks might be proposed. Specifically, the Barro outline was intended to complement The Condition of Education (Part II, 1980) description of available NCES data resources. This outline is presented in Appendix A.

After receiving the Task 4 plan of work, The Condition of Education (Parts I and II, 1980), the Barro outline, and descriptions of various ideas for indicator development projects suggested by SAGE and NCES staffs, Abbott Ferriss prepared a report detailing his suggestions of projects that might be undertaken. This report was also distributed to all Task 4 participants. Since many of the ideas presented in the report are beyond the scope of the current SAGE, they provide an important source of ideas for future NCES efforts to develop educational indicators. This report is presented in Appendix B.

Appendix A:

VARIABLES FOR MONITORING THE ECONOMIC AND  
SOCIAL CONDITIONS OF EDUCATION

(DRAFT)

Stephen Barro

VARIABLES FOR MONITORING THE ECONOMIC AND  
SOCIAL CONDITIONS OF EDUCATION

(DRAFT)

I. STUDENTS

A. Demography and the incidence of educational needs

1. School-age and school-eligible populations
2. Enrollments and enrollment rates by age
3. Characteristics of the student population
  - a. Age, sex, marital status, household structure
  - b. Race, ethnicity, national origin, primary language
  - c. Socioeconomic status (income, parents education, parents' occupations, etc.)
  - d. Labor force status (employed, formerly employed, part-time employed, veteran, etc.)
  - e. Residence (with family, at school, own household, etc.)
4. Incidence of special educational needs
  - a. Handicaps (physical, mental, emotional)
  - b. Limited English proficiency
  - c. Educational deprivation or disadvantage
  - d. Migrants, institutionalized, homebound, etc.
5. Relationships of enrollment rates to demographic and SES attributes
6. Relationships of special educational needs to demographic and SES attributes

B. Educational placement and status

1. Educational placement of students
  - a. Enrollment by type of institution and level of education (pre-K, elementary, secondary, undergraduate college, post-graduate, other postsecondary; public/private, academic vocational, 2-year or 4-year college or university, proprietary training school, etc.)
  - b. Acceptances as a proportion of applications by type and level of postsecondary institution and by student characteristics
  - c. Enrollment by program or field of study
  - d. Placement in special programs (compensatory education, remedial program, special education for the handicapped, bilingual education, gifted program, etc.)
  - e. Placement by putative destination (college-preparatory vs. vocational, junior college 2-year technical program vs. 4-year B.A. program, etc.)

2. Grouping of students (composition of schools and classes)
    - a. Degree of segregation by race or ethnicity
    - b. Degree of homogeneity with respect to SES
    - c. Extent of grouping by ability or prior performance
    - d. Extent of separation of special-need students (handicapped, limited English proficiency, etc.) from other students
  3. Educational performance--distributions of achievement test scores, SAT/GRE scores, and other performance indicators
  4. Relationships of institutional and program placement and choice of field to student demographic and SES characteristics and to prior educational attainment and performance
- C. Participation, progress, and completion
1. Continuation and completion
    - a. Year-to-year continuation and drop-out rates
    - b. Rates of advancement relative to nominal schedules
    - c. Completion rates (high school graduation, undergraduate certificate or degree, graduate degree, etc.)
    - d. Rates of transition between levels (e.g., percent of high school graduates enrolling in a postsecondary institution)
  2. Attendance
    - a. Attendance rates
    - b. Transfer and transiency rates
    - c. Total exposure in the classroom and elsewhere
  3. Re-entry and resumption of education
    - a. Rates of re-entry and completion of drop-outs
    - b. Rates of re-entry to formal schooling of adults
    - c. Placement, continuation, and completion rates of re-entering adults
    - d. Duration and frequency of continuing and recurrent education
  4. Relationships of foregoing rates (items 1-3) to student demographic and SES characteristics, institutional and program placement and choice of field, prior educational attainment and performance, and community and other environmental characteristics.

## II. INSTITUTIONS AND ORGANIZATIONS

- A. Systems and schools
  1. Numbers and sizes of systems and schools

- a. State public elementary and secondary school systems
    - i. Local school districts
    - ii. State education agencies
    - iii. Intermediate and specialized agencies
  - b. Private elementary and secondary schools and their organizations
  - c. Preschools and preschool systems--public and private
  - d. Public higher education systems--state and local systems; federal institutions
  - e. Private colleges and universities
  - f. Postsecondary vocational and technical schools--public and proprietary
  - g. Specialized institutions (e.g., for the handicapped)
2. Clientele served by systems and schools (by age, geographic area, qualifications, etc.)
  3. Levels and types of services provided by systems and schools (grade ranges, credentials offered, general types of programs and services)
  4. Organization and control of systems and schools (private or public, type of governing jurisdiction, nature of governing body, degree of independence)
- B. Institutions, students, and programs
1. The make-up of system and school populations
    - a. Composition by demographic and SES characteristics
    - b. Incidence of educational needs and problems
    - c. Composition by educational qualifications and performance
    - d. Distribution of students by geographic origin
    - e. Composition by student residence (commuter vs. on-campus; live-with-family vs. live separately, etc.)
  2. Program offerings of systems and schools
    - a. Fields of study (at elementary-secondary level includes academic vs. vocational; at higher education level includes specific subject areas and professions)
    - b. Levels of education within fields; degrees and other credentials conferred
    - c. Requirements for continuation and completion (years to complete, required examinations or other indicators of proficiency requirements)
    - d. Offerings for special-need pupils
  3. Special and comparative analyses
    - a. Institutional selectivity
    - b. Homogeneity and diversity of student populations (by demographic and SES characteristics, geography, qualifications, fields of study, etc.)

- c. Differences in student body characteristics: public vs. private elementary and secondary schools (by geographic area); public vs. private colleges and universities; 2-year colleges vs. 4-year colleges vs. universities; public vs. private preschools, etc.
    - d. Differences in programs and services offerings (same groups as above)
  - 4. Relationships between institutional characteristics and student body characteristics
    - a. Relationships between institutional size and mode of control and the make-up of the student body
    - b. Relationships between program offerings and student body composition
- C. Control and management of institutions
  - 1. Organizational auspices and affiliations
  - 2. Structures and functions of governing bodies (public schools: roles of local boards, state and intermediate agencies, parents, et al.; private schools: roles of boards, churches, other institutions, parents)
  - 3. Make-up of governing bodies (by demographic and SES characteristics, occupation, educational level, etc.)
  - 4. Extent of involvement of or control by higher authorities--state agencies, federal agencies, churches, etc.
  - 5. Extent of centralization within systems
- D. Nonschool learning environments (e.g., home, clubs, interest groups, libraries, museums)
  - 1. Composition of populations served by demographic and SES characteristics
  - 2. Types of learning activities and materials available
  - 3. Organizational auspices and affiliations (including sources of financial support)
  - 4. Relationships between nonschool environments for learning and formal educational institutions and programs (e.g., school programs that involve library-study activities)
- E. Educational research and development organizations
  - 1. Composition of research staff by demographic and educational characteristics

2. Activities and products
3. Sources of support for research and development activities
4. Dissemination and utilization of educational research and development products and information

### III. FINANCES OF PUBLIC ELEMENTARY AND SECONDARY SCHOOL SYSTEMS

#### A. Revenues and expenditures

1. Revenue of local school districts
  - a. Revenue per pupil
  - b. Revenue by type and source--local tax and nontax revenue, intergovernmental revenue from states, intermediate units, and the federal government
2. Expenditures of local school districts
  - a. Expenditure by function--instruction, administration, plant operation and maintenance, etc.
  - b. Expenditure by object--salaries of teachers, administrators, and other staff; materials and equipment; other outlays
3. Revenue and expenditures of intermediate and specialized agencies--same categories as above, as applicable
4. Revenue and expenditures of state education agencies--same categories as above, as applicable (plus intergovernmental aid, by type and recipient)
5. Expenditures of federal education agencies--by program, type of outlay, and recipient
6. Overall revenue and expenditures--consolidated data for local, state, and federal levels of government; federal, state, and local shares of overall support
7. Comparative measures of levels of revenue and expenditure
  - a. Educational support relative to GNP, national income, total public spending, social services spending
  - b. Local support for schools relative to total local outlays and social services outlays
  - c. State support relative to all state outlays and social services outlays; state aid for education relative to all state aid to local governments
  - d. Federal support relative to total federal outlays and social services outlays; federal aid for education relative to all federal aid to state and local governments

B. Fiscal characteristics of local, state, and federal education systems

1. Local revenue-raising systems

- a. Definitions of local school tax bases
- b. Local fiscal capacity: property value, income, other authorized tax bases; alternative and more general indices of fiscal capacity
- c. Constraints on local revenue raising: limits on tax rates or revenues, requirements for approval by voters or higher-level governments, fiscal dependence on general-purpose local governments
- d. Other demands for local revenue--"municipal overburden"
- e. Special features of local tax systems: circuit breakers, exemptions, differential rates of assessment or taxation, etc.
- f. Local sources of nontax revenue--tuition, other fees, etc.

2. State revenue-raising and aid allocation systems

- a. Sources of state funds for elementary and secondary education--general funds, earmarked taxes, other
- b. Allocation of state general-purpose aid to school districts
  - i. Major features of state aid formulas: type of formula (foundation, power equalizing, etc.), amounts of aid and method of computation
  - ii. Special features of state aid formulas: adjustment factors (need, cost, sparsity, urban, etc.), differentials by type of district, constraints on amounts of aid, matching provisions, etc.
- c. Allocation of state categorical aid to school districts
  - i. Types and amounts of categorical aid
  - ii. Aid formulas and other aid allocation mechanisms
- d. Fiscal requirements imposed by states on school districts
  - i. State-mandated services: types and costs
  - ii. Restrictions on local uses of funds--e.g., required staffing ratios, state-established minimum salary schedules, etc.

3. Federal aid allocations and fiscal requirements

- a. Characteristics of federal aid programs: types, amounts of aid, formulas and other distribution mechanisms
- b. Fiscal requirements imposed on states and school districts by the federal government
  - i. Fiscal requirements attached to federal grants
  - ii. Fiscal implications of federal service mandates and civil rights requirements

4. Costs of education

- a. Variations in costs of education among states and (classes of) school districts
  - i. Variations in costs of teachers
  - ii. Variations in costs of other staff

- iii. Variations in costs of nonstaff resources
    - iv. Composite cost indices
  - b. Technological cost factors: economies and diseconomies of scale, density and sparsity, climate, etc.
- 5. Relative needs for educational resources
  - a. Variations in educational needs of pupils among states and school districts
    - i. Proportions of special-need pupils: disadvantaged, handicapped, limited English proficiency, etc.
    - ii. Composite, weighted-pupil indices of relative needs
  - b. Other factors associated with differential needs: attendance and drop-out rates, crime, social and health status of pupils, etc.
  - c. Responsibilities of education agencies vis-a-vis other public agencies
- C. Fiscal behavior of state and local education agencies
  - 1. Fiscal behavior of state education agencies
    - a. State fiscal effort to support elementary and secondary education (relative to income, other capacity measures, other public sector outlays, etc.)
    - b. Estimated responses of state education outlays to changes in federal aid
    - c. Estimated responses of state education outlays to changes in the fiscal circumstances of local districts
    - d. Estimated effects on state education outlays of changes in state economic, demographic, and other conditions
  - 2. Fiscal behavior of local school districts
    - a. Local fiscal effort to support elementary and secondary education (distributions by classes of districts, state and national averages)
    - b. Estimated responses of local education outlays to changes in state and federal aid
    - c. Estimated effects on local education outlays of local economic, demographic and social characteristics, characteristics of pupils, and costs of education
  - 3. Voter behavior
    - a. Rates of voter approval of school district budgets, tax increases, and school bond issues
    - b. Estimated effects on voter behavior of fiscal and economic conditions, demographic factors, etc.

D. Comparisons of resource distribution in public school finance

1. Interstate and interdistrict disparities in support for schools
  - a. Disparities in per-pupil spending and components thereof
  - b. Disparities in real (cost-adjusted) per pupil spending
  - c. Disparities in real spending relative to educational needs
  - d. Disparities in tax rates, tax burdens, and tax effort for education
2. Relationships of per-pupil support for education to state and local income, wealth, and fiscal capacity
3. Relationships of per-pupil support for education to characteristics of pupils
  - a. Family income and other measures of economic status
  - b. Race, ethnicity, and language
  - c. Handicapping conditions and other special educational needs
4. Estimated effects on resource distribution of state and federal roles in school finance
  - a. Estimated effects on above indicators of state systems for allocating general-purpose aid
  - b. Estimated effects of state and federal categorical grants
  - c. Estimated effects of state and federal service mandates and civil rights requirements
  - d. Estimated effects of deductability of school taxes from federal and state taxable income

IV. FINANCES OF PRIVATE ELEMENTARY AND SECONDARY SCHOOLS

A. Private school revenues and expenditures

1. Revenue by source, specifically including
  - a. Tuition payments
  - b. Subsidies from churches and other organizations
  - c. Endowment income
  - d. Contributed services (of religious personnel, volunteers, and others paid below market wages)
  - e. Charitable contributions
  - f. Aid from local, state, and federal governments
2. Expenditures
  - a. Expenditure by function, as for public schools
  - b. Expenditure by object, as for public schools
  - c. Imputed expenditures with resources priced at market levels

- B. Finances of families with children in private schools
  - 1. Burdens of private school tuition and contributions
  - 2. Relationships between tuition payments and family financial characteristics
  - 3. Relative financial status of families with children in private and public schools
- C. Demand for private education
  - 1. Rates of enrollment in private school
  - 2. Association of private enrollment with family characteristics: SES, race, ethnicity, religion, family size, etc.
  - 3. Estimated effects of tuition levels on private school enrollment
  - 4. Estimated effects on private school enrollment of conditions in local public schools: financial and service characteristics; severity of educational and other problems; SES, ethnic, and racial mix; busing programs, etc.
  - 5. Estimated effects of subsidies and tax credits on private enrollment
- D. Supply of private education
  - 1. Estimated capacity (number of places) in private schools
  - 2. Tuition rates charged by private schools
  - 3. Estimated responses of capacity and tuition rates to changes in application rates, availability of subsidies or tax credits, and characteristics of the population
- E. Indicators related to school finance resource distribution
  - 1. Fiscal disparities among private schools (both among and within categories of schools)
  - 2. Relationships between type of private school attended and pupil and family characteristics (income, race, ethnicity, etc.)
  - 3. Degrees of heterogeneity and diversity in private school student bodies
  - 4. Comparative expenditures of private schools and public schools in the same areas

5. Impact of federal and state income taxes on families with children in private and public schools

V. FINANCES OF PUBLIC AND PRIVATE PRESCHOOLS

- A. Revenues and expenditures
- B. Finances of families with children in private preschools
- C. Fiscal characteristics of local, state, and federal education systems for preschool learning
- D. Demand for public and private preschool programs
- E. Supply of public and private preschool programs
- F. Comparisons of resource distribution in the financing of public and private preschool programs

VI. FINANCES OF PUBLIC AND PRIVATE INSTITUTIONS OF HIGHER EDUCATION

- A. Revenues and expenditures of institutions of higher education
  1. Revenue by source, specifically including
    - a. Tuition payments
    - b. Endowment income
    - c. Contributions from individuals, businesses, foundations, churches, and other organizations
    - d. Contributed services (of religious personnel, etc.)
    - e. Appropriated funds from sponsoring government agencies
    - f. Grants from other government agencies (including federal and state research grants)
  2. Expenditures
    - a. Expenditure by function (instruction, research, student services operation and maintenance, debt service, etc.)
    - b. Expenditure by object (faculty salaries, administrative and support staff salaries, research outlays, buildings and equipment, materials, financial aid to students, other expenditures)
    - c. Expenditures by program and field of study
    - d. Expenditures by level of education--2-year programs, 4-year undergraduate programs, graduate education, post-graduate education, research, etc.
- B. Assets and liabilities of institutions of higher education
  1. Value of physical plant and equipment

2. Value of endowment funds and other financial assets
3. Debt--long and short term
- C. Finances of students and their families
  1. Costs to students and families
    - a. Tuition charges
    - b. Room, board, and other costs of higher education
    - c. Estimates of foregone earnings
  2. Sources of support
    - a. Support from families
    - b. Student earnings
    - c. Other support from personal sources
    - d. Financial aid
      - i. Institutional aid
      - ii. Local, state, and federal government aid
      - iii. Other private and public organizations
    - e. Loans
      - i. Government or government-guaranteed loans
      - ii. Private loans
  3. Burdens of higher education costs (relative to family income and wealth, students' own present and prospective earnings, etc.)
  4. Relationships between costs of higher education and family financial characteristics
- D. Financing of public institutions
  1. Expenditures of state and local governments for higher education
    - a. Direct state expenditures for state-operated systems
    - b. Direct local expenditures
    - c. State aid for locally operated institutions
    - d. State and local direct financial aid to students
  2. Higher education revenue, by source
    - a. Sources of state revenue (general funds, earmarked taxes, nontax revenue, etc.)
    - b. Sources of local revenue (general funds, special higher education taxes, fees, etc.)
    - c. Intergovernmental revenue
      - i. State aid to local authorities
      - ii. Federal higher education aid to states
      - iii. Federal higher education aid to local authorities
      - iv. Federal research grants and contracts

3. Fiscal behavior of state and local agencies supporting institutions of higher education
    - a. Tax rates or measures of fiscal effort to support higher education
    - b. Estimated effects of factors influencing state and local higher education spending
      - i. Federal and state aid
      - ii. Costs of education
      - iii. Economic, demographic, and other characteristics of jurisdictions
      - iv. Characteristics of students and applicants
- E. Demand for higher education
1. Rates of enrollment in institutions of higher education
  2. Association of enrollment in institutions of higher education with student and family characteristics; differentials by type of institution
  3. Estimated effects of tuition levels and other costs of higher education on private school enrollment and its composition
  4. Estimated effects of financial assistance on enrollment
    - a. Federal student aid programs
    - b. Other student aid programs
    - c. Effects of government and government-guaranteed loan programs
  5. Estimated effects of other enrollment determinants: demography and SES, economic and labor market conditions, etc.
- F. Indicators related to school finance resource distribution
1. Fiscal disparities among institutions of higher education (between public and private, among and within classes of institutions)
  2. Relationships between levels of outlays of institutions and characteristics of their students
  3. Redistributive effects of public higher education
    - a. Distribution of tax burdens and other costs
    - b. Distribution of benefits
    - c. Distribution of net benefits (benefits less costs)
  4. Effects of federal aid on fiscal disparities among institutions and on distributions of benefits and costs

## VII. FINANCES OF PROPRIETARY POSTSECONDARY SCHOOLS

- A. Revenues and expenditures for proprietary postsecondary schools
- B. Assets and liabilities of proprietary schools
- C. Finances of students and their families
- D. Demand for proprietary postsecondary programs
- E. Supply of proprietary postsecondary programs
- F. Indicators related to school finance resource distribution

## VIII. RESOURCES

- A. Overall patterns of resource allocation
  - 1. Composition of educational "market baskets"
    - a. Expenditure shares by resource category
    - b. Quantities and prices of resources (including staffing ratios and staff salaries)
    - c. Incremental and decremental budget shares (i.e., allocation of expenditure increases and decreases by resource category)
    - d. Relationship of market basket composition to type and level of institution, level of financial support, and student body and community characteristics
  - 2. Determinants of budget allocation
    - a. Estimated effects of level of funding, forms of financial support, and prices of resources
    - b. Estimated effects of legal, institutional, and contractual constraints
    - c. Estimated effects of institutional, community, and student body or user characteristics
- B. Teachers and other instructional staff--elementary and secondary education
  - 1. Numbers and characteristics
    - a. Numbers of staff and staff-pupil ratios, by category of staff and rank
    - b. Averages and distributions of staff characteristics--experience, level and type of education, specialization, age, race, sex, etc.
    - c. Performance measures: test scores, competency measurements, indices of quality of training institutions, etc.

## 2. Utilization and assignment

- a. Days and hours of work; breakdown by type of activity (formal instruction, preparation, correction of student work, other instructional activities, auxiliary assignments, administrative functions)
- b. Staff allocation by grade level, program, type of school, category of pupil
- c. Relationships between teacher characteristics and pupil/program characteristics; policies for matching staff and pupils
- d. Type of teaching situation: self-contained classroom, combination of teacher and paraprofessional, specialization by subject area, other use of specialists, team teaching, etc.
- e. Teaching loads: class sizes, pupil load, number of periods per day
- f. Subject area assignments; match of assignment to training
- g. Rates of turnover, transfer among schools, change in assignment

## 3. Compensation

- a. Salary levels and salary schedules
- b. Fringe benefits
- c. Total compensation--nominal levels and adjusted for cost of living and variations in days and hours worked

## 4. Hiring and career paths

- a. Numbers and characteristics of new hires; comparison of new hires with existing staff
- b. Sources of new hires: direct from teacher training institutions, from other school systems, from other occupations, from paraprofessionals, etc.
- c. Rates of turnover, attrition, and retirement: rates of transfer from and to other occupations
- d. Career paths within school systems: rates of promotion, transfers among positions within systems, transfers among systems; differential probabilities of advancement by characteristics of staff

## 5. Labor organizations and collective bargaining

- a. Extent of membership in teacher unions and other labor organizations (composition by type and affiliation of organization)
- b. Status of unions and collective bargaining in school systems: legal status, recognition as bargaining agent, presence of multiple agents, union or agency shop, existence of formal contract or other form of agreement, scope of collective bargaining

- c. Characteristics of contracts: presence of specific features, such as workload limits, grievance procedures, arbitration, transfer rules, seniority rules, guarantees of professional autonomy, etc.
- d. Labor disputes: strikes, arbitration, litigation, number of grievances, etc.
- e. Governance role of teacher organizations: participation in district or school-site management, membership on school boards, extent of lobbying at state and local levels
- f. Estimated effects of labor organizations and features of contracts on teachers' job security and compensation, average ability and experience of teaching staff, cost of education, and quality of education

#### 6. Retirement systems

- a. Numbers of current and projected retirees
- b. Benefit levels; provisions governing changes in benefits (e.g., cost of living increases)
- c. Finances of retirement systems (method of funding, current flows of funds, accrued and projected liabilities)
- d. Economic status of retirees

#### 7. Teacher effectiveness

- a. Estimated effects of personal characteristics of teachers on student performance (including effects of match between teacher and student characteristics)
- b. Estimated effects of teacher experience, training, and other professional development on student performance
- c. Estimated effects of specific teaching behaviors on student performance

#### 8. Job satisfaction and related attitudes

- a. Reported job satisfaction of teachers and other staff
- b. Reported intention to remain in teaching
- c. Perceptions of severity of educational problems
- d. Reported satisfaction with organizational, administrative, and other institutional factors

#### 9. Supply and demand of teachers and other instructional staff

- a. Estimated effects of various factors on demand for teachers and other instructional staff
  - i. Economic and fiscal characteristics of districts
  - ii. Characteristics of pupils and community
  - iii. Salaries and other elements of compensation
- b. Estimated effects of various factors on supply of teachers and other instructional staff
  - i. Characteristics of school systems and schools (amenities and disamenities)

- ii. Economic conditions (opportunity wage, unemployment rate, etc.)
    - iii. Working conditions in schools (class sizes, availability of supporting resources, discipline and other problems, characteristics of student body)
    - iv. Salaries, salary schedules, and other elements of compensation
  - c. Determinants of salaries, other compensation, and working conditions
    - i. Effects of district economic and fiscal characteristics
    - ii. Effects of characteristics of community and student body
    - iii. Effects of economic conditions (opportunity wages, cost of living, aggregate demand and supply in teacher market, etc.)
    - iv. Effects of unions and collective bargaining
- C. Administrative staff--elementary and secondary education
  - 1. Numbers and characteristics of staff
    - a. Numbers of staff and staff-pupil ratios, by category of staff and rank
    - b. Averages and distributions of staff characteristics--experience, level and type of education, specialization, age, race, sex, etc.
    - c. Performance measures: test scores, competency measurements, indices of quality of training institutions, etc.
  - 2. Utilization and assignment
    - a. Workload measures: number of days and hours; number of staff and students administered, etc.
    - b. Functions and activities: portions of time devoted to supervision of instruction, personnel administration, dealing with student problems, transactions with higher or lower administrators, external relations, financial management, preparation of reports, etc.
    - c. Relationships between administrative staffing patterns and characteristics of communities, students, and instructional staffs
    - d. Rates of turnover, transfer, change in assignment
  - 3. Compensation
  - 4. Hiring and career path
  - 5. Labor organizations and collective bargaining
  - 6. Retirement systems
  - 7. Job satisfaction and related attitudes
  - 8. Supply and demand

- D. Support staff--elementary and secondary education
  - 1. Numbers and characteristics
  - 2. Utilization and assignment
  - 3. Compensation
  - 4. Labor organizations and collective bargaining
  - 5. Retirement systems
- E. Faculty and other instructional staff--higher education
  - 1. Numbers and characteristics
    - a. Numbers of faculty and other instructional staff and ratios of staff to students, by category of staff, rank, level of education, program, and field of study
    - b. Averages and distributions of staff characteristics: age, sex, race, level of education, degrees, quality of undergraduate and graduate institutions, teaching and research experience, publications, etc.
  - 2. Utilization and assignment
    - a. Workload indicators: courseloads, student loads (class enrollment, individual students supervised, etc.)
    - b. Functions and activities: allocations of time to teaching (direct instruction, preparation, grading papers, etc.), research, administrative functions, other service to institution or community
    - c. Type of teaching situation: individually taught courses, team teaching, seminars, use of graduate teaching assistants; large lecture, small sections, tutorials, etc.
    - d. Type of research situation: individual research with no special funding, funded research, collaborative projects; use of graduate research assistants; use of special research facilities; etc.
  - 3. Compensation
    - a. Salary levels and salary schedules
    - b. Fringe benefits
    - c. Total compensation
  - 4. Hiring and career paths
    - a. Numbers and characteristics of newly hired faculty; comparison with existing faculty
    - b. Sources of new hires: direct from graduate school, from other institutions or same institution, from teaching positions elsewhere, from outside higher education
    - c. Rates of promotion, retention, turnover, attrition, retirement; transfers to and from other occupations, transfers to administrative and other positions within institutions
    - d. Outside employment: consulting, government service, etc.

5. Labor organizations and collective bargaining
6. Retirement systems
7. Faculty performance
  - a. Institutional evaluations: rates of promotion, tenuring, retention; years elapsed between promotions
  - b. Student ratings of faculty members
  - c. External criteria: ratings by outside evaluators, publication records, professional recognition
  - d. Performance by faculty characteristics
8. Job satisfaction and related attitudes
9. Supply and demand of faculty
- F. Administrative staff--higher education
- G. Support staff--higher education
- H. Educational capital (buildings, other facilities, equipment, etc.)
  1. Number and characteristics of buildings and other facilities
    - a. Number and size of classroom buildings, lecture halls, laboratories, gymnasiums, residence halls, etc.
    - b. Characteristics of facilities: age, condition, student capacity, etc.
    - c. Real estate holdings of educational institutions--size, value
    - d. Other physical capital (including computers, special research installations, utilities, transportation facilities, etc.)
  2. Value of educational buildings and facilities
    - a. Value according to alternative valuation concepts: book value, replacement value, depreciated value, market value if sold, etc.
    - b. Value of capital resources per pupil; relationship to value of current inputs per pupil
  3. Equipment: amounts, characteristics, and value
    - a. Availability of items of equipment, by category
    - b. Value of equipment per pupil
  4. Rates of investment in educational capital
    - a. Rate of construction of buildings and facilities (in physical units--numbers of schools, classrooms, etc.)
    - b. Value of new construction
    - c. Value of replacement, improvement, upgrading of capital
    - d. Value of equipment purchases

5. Financing of capital

- a. Modes of financing of new investment: current funding, sinking funds, special grants or donations, debt issues
- b. Debt service on capital: amounts of annual debt service, principal outstanding, maturity dates

I. Other educational resources

1. Educational materials

- a. Amounts consumed per student or user
- b. Expenditures for materials
- c. Estimated consumption and costs of materials purchased by students or users

2. Energy

- a. Consumption of fuel, power, etc. by educational institutions
- b. Expenditures for energy

3. Other consumable resources

- a. Amounts consumed
- b. Expenditures

IX. EDUCATIONAL SERVICES AND PROCESSES

A. Program and curricular offerings

- 1. Fields of study--percentages of institutions offering particular fields, programs, or capabilities
  - a. Elementary and secondary schools: college-preparatory, vocational, and general programs; particular vocational fields
  - b. Higher education institutions: major fields of study, professions; degrees and other credentials offered in each
- 2. Subjects of instruction--percentages of schools and nonschool learning environments offering specified subjects or courses
- 3. Offerings for special-need pupils or users--percentages of schools and nonschool learning environments with special programs or other provisions for disadvantaged, handicapped, limited English proficient, and other special pupils
- 4. Variations in breadth, specialization, and classroom exposure of offerings

B. Resource configurations in instruction

1. Staffing patterns (by type of institution, program, and curricular area)
  - a. Class sizes
  - b. Staff attributes--staff rank, level of education, specialized training, etc.
  - c. Incidence of particular staffing patterns--e.g., self-contained classroom, aides in classroom, itinerant subject-area specialists, single faculty member, faculty member plus teaching assistants, team teaching, etc.
2. Resources other than staff
  - a. Use of instructional technologies--TV, computer-aided instruction, other audio-visual, etc.
  - b. Use of facilities--classrooms, laboratories, shops and equipment, athletic facilities, medical facilities, etc.
  - c. Types and amounts of materials

C. Time allocations

1. Amount of student time in instruction
  - a. Time in formal instructional activities
  - b. Other "learning" time--reading, homework, fieldwork, etc.
2. Staff time per student
  - a. Direct instructional time
  - b. Other staff time--preparation, review of student work, etc.

D. Instructional organization, process, and method

1. Instructional scheduling
  - a. Organization by the year (e.g., quarters or semesters, length of courses, use of innovative modes of scheduling)
  - b. Organization by the day (e.g., numbers of different courses or subjects per day, length of periods, uses of flexible scheduling)
2. Modes of instruction--"regular" programs
  - a. Frequency of use of different modes of instruction--lecture, lecture-recitation, seminar, small-group activities, tutorial, independent study, interaction with computers or other technological systems, TV teaching, etc.
  - b. Variations in use of different modes--by program and curricular area, type of student, and level of instruction

3. Modes of instruction--programs for special-need students

- a. Frequency of use of different modes of instruction--as above
- b. Relationship of instruction for special-need students to instruction for regular students: use of "pull-out" approach, incidence of "mainstreaming" vs. separate instruction, use of special approaches within regular classrooms, use of special instruction modes and settings (e.g., for handicapped)

4. Instructional methods and strategies

- a. Frequency of use of specific instructional methods
- b. Frequency of use of specific subject matter strategies--e.g., phonics for elementary reading, "new math," discovery learning, etc.

E. Curriculum

- 1. Curriculum and course requirements for program completion and entrance into next educational level--composition by subject areas and levels of subject matter
- 2. Degree of student or user choice in curriculum
- 3. Actual courses undertaken and completed by students or users--by program and field of study

F. Noninstructional services and processes

- 1. Health services
- 2. Psychological services and counseling
- 3. Attendance services
- 4. Placement services
- 5. Student transportation
- 6. Room and board
- 7. Recreational services

X. OUTCOMES

A. Educational attainment and performance

- 1. Years of school completed
- 2. Credentials obtained

3. Measured achievement
  4. Other performance indicators (attitudes, social behavior, etc.)
  5. Determinants of educational attainment and performance
    - a. Influences of family background, ability, community characteristics, and other nonschool factors
    - b. Influences of educational services, school resources, and other educational factors
    - c. Relationships between earlier and later performance
    - d. Relationships between attainment and performance
- B. Placement
1. Rates of placement
    - a. Higher education, by level and type
    - b. Employment and labor force participation
    - c. Unemployment and underemployment
  2. Quality of placement
    - a. Quality of higher education institutions
    - b. Level/status of fields of study
    - c. Level/status/desirability of initial employment
  3. Determinants of placement
    - a. Influences of family background, ability, community characteristics, and other nonschool factors
    - b. Influences of educational services, school resources, and other educational factors
    - c. Influences of educational attainment and performance
    - d. Influences of choice of field and geographic location
    - e. Influences of labor market conditions
- C. Earnings and other labor-market outcomes
1. Earnings from employment
    - a. Short-term earnings after schooling
    - b. Long-term earnings, age-earnings profiles, and present value of earnings
  2. Labor market participation and employment
    - a. Labor market participation rates
    - b. Employment, unemployment, and underemployment rates
    - c. Annual weeks and hours of work

3. Occupational choice and placement
  - a. Level/status/desirability of occupation
  - b. Occupational change and advancement over time
4. Job satisfaction ("psychic benefits" of employment)
  - a. Short-term satisfaction after schooling
  - b. Longer-term career satisfaction
5. Determinants of earnings and other labor-market outcomes
  - a. Influences of family background, ability, community characteristics, and other nonschool factors
  - b. Influences of educational services, school resources, and other educational factors
  - c. Influence of educational attainment and performance
  - d. Relationships among age, experience, education, and earnings
  - e. Relationships among labor-market outcomes (e.g., relationship of earnings to occupational choice)
- D. Other economic outcomes for individuals
  1. Personal wealth
    - a. Real estate and consumer durables
    - b. Financial assets
    - c. Debt
  2. Leisure time
    - a. Amounts
    - b. Uses
  3. Household income (including earnings and other sources)
    - a. Per capita income
    - b. Household disposable income
  4. Incidence of poverty and dependency
    - a. Poverty rates
    - b. Dependency rates
    - c. Dependence on public assistance--frequency, duration, types
  5. Occupational mobility
  6. Geographical mobility
  7. Education and related self-improvement activity after schooling
    - a. Participation rates in adult, recurrent, mid-career education
    - b. Rates of return to formal schooling
    - c. Participation in on-the-job training

8. Determinants of other economic outcomes
  - a. Influences of family background, ability, community characteristics, and other nonschool factors
  - b. Influences of educational services, school resources, and other educational factors
  - c. Influences of educational attainment and performance
  - d. Relationships between labor-market and other economic benefits
- E. "Noneconomic" outcomes for individuals
  1. Health and mental health status
  2. Cultural level and activity
  3. Participation in political, community, and organizational affairs
  4. Family structure and activities
  5. Household consumption patterns
  6. Recreational activities
  7. Crime, delinquency, and other antisocial behavior
  8. Interpersonal relationships
- F. Economic outcomes for society
  1. Effects of education on levels of economic activity
    - a. Employment, income, and output
    - b. Productivity
    - c. Savings and investment
    - d. Rates of economic growth
  2. Effects of education on distribution and equity
    - a. Effects on earnings, income, and wealth distributions
    - b. Effects on the distribution of persons by occupational level and status
    - c. Interaction of education with other influences on distributions and equity (including race, sex, and other personal characteristics, family background, etc.)
    - d. Contribution of education to geographical differentials in incomes and other economic indicators
  3. Effects of education on the labor market and the organization of production
    - a. Effects on the organization and division of labor
    - b. Effects on job qualifications and procedures for selecting employees ("screening," "credentialing," "professionalization")

- c. Effects on the competitive positions of different groups (minorities, women, youth, etc.)
  - d. Substitutability of educated labor for capital and less-educated labor
- 4. Contributions of education to technological progress
  - a. Effects on research and innovative activity
  - b. Effects of an educated labor force on the rate of adoption of innovations
- G. Education as an investment
  - 1. Private rates of return (absolute and relative to other investments)
    - a. Return to additional years of schooling
    - b. Return to additional investment per year of schooling (by type of student, level of education, type of institution and program, etc.)
  - 2. Social rates of return (absolute and relative to other social investments)
    - a. Return to additional years of schooling (or additional schooling for more students)
    - b. Return to additional investment per student-year of schooling (by level of education, type of institution and program, field of study, characteristics of students, etc.)
  - 3. Riskiness of education as an investment--variability of returns relative to those of other investments
  - 4. Trade-offs between rates of return and other outcomes (e.g., equity)

Appendix B:

SUGGESTIONS FOR DEVELOPING SOCIAL INDICATORS OF EDUCATION

(DRAFT)

Abbott Ferriss

## SUGGESTIONS FOR DEVELOPING SOCIAL INDICATORS OF EDUCATION

### 1. School Districts

Source: Dortman, W., & Ferrara, L. Social and economic characteristics of U.S. school districts, 1970. Washington, D.C.: U.S. Government Printing Office, 1975.

The data used in the above publication were generated from the 1970 U.S. Census, after the boundaries of school districts had been delineated so that Census data could be tabulated by school district. These data are combined with data from the Elementary and Secondary General Information Survey (ELSEGIS) conducted by the National Center for Education Statistics and are available on a data tape identified as (combined) Census/ELSEGIS School District Data. Apparently, no publication of educational indicators has resulted from the combined tape.

The above-referenced publication provides the 1970 basis for developing a sampling frame from which to select a sample of school districts and schools for an intensive analysis of the educational system. NCES has established the practice of conducting extensive sampling surveys. For example, in the 1972 "Anchor Test Study" of 5th grade reading achievement, 918 schools were selected for the sample and 192,749 pupils were tested. Another example is reported under the NCES title, Statistical Survey of Elementary Schools: Development of a Large-Scale Survey, 1972-74.

According to The Condition of Education: NCES Program and Plans (1980 edition, p. 8), "NCES is planning to transform decennial census data to a school district base." This updating of the 1970 use of Census and school district data will provide a basis for (a) developing a 1980 sampling frame for school districts and schools and (b) studying changes from 1970 to 1980 in school district characteristics. A model has been developed for the use of such data in the field of mental health. Three references will serve to identify this body of work:

- (a) Rosen, B. M., Goldsmith, H. F., & Redick, R. W. Demographic and social indicators: Uses in mental health planning in small areas. World Health Statistics, 1979, 32(1).
- (b) Goldsmith, H. F., & Unger, E. L. Social area analysis: Procedures and illustrative applications based upon the mental health demographic profile system. Census Tract Papers, 1973 (Series GE 40, No. 9), 50-72.
- (c) Goldsmith, H. F., et al. A typological approach to doing small area analysis. (DHEW Publication No. ADM 76-262.) Washington, D.C.: U.S. Government Printing Office, 1975.

The procedures described in these papers permit a local area to be characterized in terms of demographic measures. Studies have been conducted and additional ones are underway, particularly in areas of St. Louis, Baltimore, New Haven, and Gainesville, that relate clinical evidence of mental conditions to socioeconomic characteristics of the geographic area, termed "catchment areas."

Analogous to this model, the demographic characteristics of school districts could be related to criteria of school performance: motivation of student, achievement levels, dropout rates, school continuation rates, school characteristics based upon fiscal data, teacher characteristics, and the like. To the extent that relevant characteristics are available on the Census/ELSEGIS files for 1970 and 1980, the study of demographic profiles and school characteristics could be conducted using 100% of U.S. school districts. To the extent that supplementary information would need to be collected (e.g., 5th grade reading achievement scores), a sample of districts and schools could be selected for this purpose and the data merged with the Census/ELSEGIS data. Conducting such studies periodically would provide a comprehensive basis for developing indicators of the elementary and secondary educational system.

Distributions of characteristics from the 1970 tape for comparison with the 1980 tape, similarly developed, would provide indicators of change over the decade. The analysis of changes in school performance criteria due to changes in school district inputs would provide an understanding of intervening processes that could guide policy and program

development during the 1980s. Numerous possibilities could be worked out in detail with the codebook of the data, information on the distribution of characteristics, and knowledge of previous analyses of demographic characteristics and their relation to school performance characteristics. For example, measures of illiteracy for school children by county were acquired in Florida through testing, and these test scores were predicted with high precision upon the basis of socioeconomic characteristics of the county population.

If we were equipped with the potential for annually sampling school districts, what characteristics should be monitored? Assuming that a representative sample of school districts would be surveyed annually, the following are some of the educational indicators that might be monitored:

1.1 The number of substandard teachers hired at the time of the fall opening of school, expressed as a percent of all teachers. (This is not a global statistic, but one distributed across school districts. Consequently, it provides information on the variability of the indicator-- something impossible from aggregated data collected through state departments of education.) This indicator would reflect staffing problems according to the characteristics of the school districts, information that may be useful in program planning to meet such staffing problems.

1.2 Teachers' salaries in relation to salaries in the same districts of other professions with comparable educational experience. (From the information on the 1970 Census/ELSEGIS data tape, it is not clear that this statistic can be generated; however, arrangements could be made for the 1980 data file to report median income by educational level for comparison with teachers' salaries by educational level.) These data could be generated by sex and race for comparisons within school districts.

1.3 The degree of integration of ethnic groups in the schools, expressed as the percentage of all pupils of ethnic background enrolled in integrated schools. Alternatively, the percentage of students of ethnic background by school might be used. It is important that time series be assembled and that the school data be classified by the percentage of

persons of various ethnic backgrounds in the population of the district as of the base year (e.g., 1980).

1.4 The adequacy of the curriculum. In Goals for America, the Gardner report stated: "In high school, every academically talented student should study four years of English, four years of mathematics, four years of one foreign language, at least three years of science, and three years of social studies" (1960, p. 85). To accurately assess the attainment of this goal, high school seniors would have to be classified according to academic aptitude (a 9-point scale would be adequate for this purpose) and according to the number of years of their high school study of these subjects. It is not sufficient to report that the curriculum of the school "offers" a program providing "x" years in each of the subjects. Rather, it is necessary to show that the graduating seniors completed programs that included various numbers of years schooling in the subjects. This information may be obtained on students who were graduated the preceding year.

1.5 The drop-out rate. The percentage of 11th grade students who did not continue to the 12th grade (and continue to reside within the district).

1.6 Expenditure for instruction per pupil, by type of school.

1.7 Achievement test scores (as might be obtained by subject from tests administered as part of the National Assessment of Educational Progress) classified by various school characteristics, e.g., pupil/teacher ratio, availability of various types of learning resources, SES and related characteristics of the districts, years of teaching experience of teachers, level of education of teachers, and so on.

1.8 The process of education. Indicators of the process of education should be the fundamental concern in the development of indicators of the educational system. The National Assessment of Educational Progress is providing periodic reviews of what is learned. Sample studies of school

districts and schools could further identify influences that affect learning and the capacity to learn. Some of these, which may be subject to such periodic sampling determinations, are:

1.8.1 By grade and age, the state of the cognitive development of the child, determined through testing.

1.8.2 Measures of the access of children to information about the world from media outside the school system; that is, newspapers, magazines, television, radio, conversation with adults, etc.

1.8.3 Reading skills and the use of information so acquired to arrive at decisions.

1.8.4 The extent of use of various standardized (or identifiable) methods of instruction in the classroom.

1.8.5 Continuation of secondary school graduates into higher education and the influences impeding such continuation.

1.8.6 The extent to which elementary and secondary schools enable children from different ethnic and cultural backgrounds to respect and appreciate their own and others' origins.

1.8.7 Measures of the safety and security of persons in the school environment and of the changes in responsibilities for maintaining safety and security as students progress through the grades.

The above (1.8.1-1.8.7) will be recognized as items of "fundamental research topics relevant to education" from the NRC/NAS report to NIE entitled Fundamental Research and the Process of Education (Kiesler, S. B., & Turner, C. F., 1977). Questionnaires of information to be obtained from teachers and students as well as instruments for testing and related procedures would have to be developed. Periodic determinations made through sampling districts and schools would provide educational indicators in time series, much as the Current Population Survey has provided

monthly and annual determinations of aspects of family, employment, income, and so forth, since 1947.

The above examples illustrate the types of information that might be collected periodically through use of a sample of school districts. The range of indicators obtained through this means would be limited only by the resources devoted to the project. Primary emphasis should be placed upon the learning process and resulting achievements. Secondary emphasis should be given to other features of the school system. The initial step in this program would be analysis of the 1970 Census/ELSEGIS School District Data and the design of the comparable 1980 data set. The wide range of additional topics that might be included in such a social indicator system are listed in the manuscript by Stephen Barro, Variables for Monitoring the Economic and Social Conditions of Education, attached as Appendix A to this report.

## 2. Elementary and Secondary Schools

Sources: Statistics of Public Elementary and Secondary Day Schools (NCES, annual) and parallel statistics for nonpublic schools.

Aggregate statistics reported over time for elementary and secondary schools provide data for (a) macro models of the supply and demand of teachers, (b) estimating transition coefficients for student movement from one grade to another, and (c) assessing the output of graduates in relation to input of students to the system. The following examples illustrate indicators that can be established from extant data and used to monitor current trends.

2.1 Enrollment by grade. Expressed in aggregate, this statistic in time series describes varying enrollment requirements. Expressed as cohorts, assuming orderly progression year to year from one grade to the next, the series provide the educational histories of vintages of students and of the patterns of educational continuation for successive generations. In time series, these statistics enable forecasts of changes in

enrollment by grade. (Comparable data from the annual October CPS survey can be used to provide verification.) An example of the use of these data in cohort form is provided by "estimated retention rates, fifth grade through college entrance," beginning with the 5th grade in 1924 and continuing to the most recent year of high school graduation, a series that is routinely published in the Digest of Educational Statistics.

Cohort values also may be used to generate transition coefficients from one grade to another. For each grade, these coefficients provide important educational indicators. To illustrate, the continuation ratio from the 10th to the 11th grade is sensitive to a change in the per capita Gross National Product, to the unemployment rate, and to expansion of the military. When time is held constant, continuation to the 11th grade is positively associated with unemployment ( $r=.45$ ), negatively associated with per capita GNP ( $r=-.36$ ), and negatively associated with an expansion in the military forces ( $r=-.42$ ). Altogether, an index of time, unemployment, and military expansion account for 88% of the variance in the continuation ratio, 10th to 11th grade. (The preceding results are reported in Ferriss, Indicators of Trends in American Education, 1969, pp. 38-44.) Results of this type are developed from time series on the basis of macro dynamic structural equations that enable the identification of systematic influences upon the criterion (in this instance, the continuation ratio). An example of such analysis is presented in Marcus Felson and Kenneth C. Land, A Dynamic Macro Social Indicator Model of Changes in Educational Enrollment, Attainments, and Organizations in the United States: 1947-74 (Urbana, IL: University of Illinois, Department of Sociology and Social Science Quantitative Laboratory, 1976). Analysis of continuation ratios may also be conducted by state, but such data are subject to the effects of interstate migration to a greater extent than are national totals.

2.2 Graduates. The interface between high school graduates and entrance into the next higher level of study provides an indicator of "efficiency" in the educational system. The ratio of first-time college enrollment to high school graduates the previous June provides one such indicator. Another is provided by the ratio of college baccalaureates to high school graduates four years earlier.

2.3 Teachers. In the current period of declining elementary and secondary enrollments, there has not been a corresponding decline in instructional staff, with the consequence that the ratio of pupils to teachers has declined, a movement thought beneficial to learning in the classroom. By 1985 or thereabouts, however, the elementary school population 5 to 13 years of age will begin to increase, and unless additions are made to the instructional staff, the pupil/teacher ratio may begin to increase. Considerations such as these may be informed by an accounting of teachers and instructional staff, by level of school. Series describing the supply and demand of teachers should be combined with information on earned degrees, retirement rates, transfer rates to other industries, and so on to develop analytical models (e.g., Folger, J. K. The Balance between Supply and Demand for College Graduates. The Journal of Human Resources, 1967, 2, 143-169). Some of these indicators include:

2.3.1 The aggregate number of teachers, by elementary and secondary levels, by sex, for public and nonpublic schools.

2.3.2 The pupil/teacher ratio, by level, for public and nonpublic schools.

2.4 Administrative and professional personnel in elementary and secondary schools. Using data aggregated to the national and state levels, indicators could be developed of the superstructure surrounding the classroom. With the increasing size of school districts, one would expect the numbers of administrative and professional personnel to increase. Indicators in the form of ratios of such personnel to the number of schools and to current expenditures for various purposes could be computed in time series. Interstate comparisons would enable a gross assessment of the different administrative models being followed. More detailed examination of such systems, however, would be required for a definitive understanding of trends.

2.5 Schools. ELSEGIS provides information on the aggregate numbers of schools classified into eleven categories (one-teacher schools through special education schools for the handicapped). Changes in the

organization of schools, particularly by state, reveal important decisions, usually at the district level, and these trends should be monitored. What changes have taken place in the "structure of education in the United States," a schematic model presented in each issue of NCES's Digest of Educational Statistics? Current changes in enrollment are bringing about changes in the number and types of schools, changing demands from industry and commerce for technicians are affecting the numbers of vocational-technical schools and institutes, and court requirements for busing pupils are affecting the size and distribution of schools and the public/private mix, at least, of elementary schools. Indicators of the number of schools by type would provide the basis for such a study of changing organization of schools.

2.6 Revenues, expenditures, salary, etc. A number of indicators from these data have been computed by state. These include such indicators as: (a) interquartile range and quartile deviation of current expenditure per pupil, (b) U.S. average and lowest and highest state averages of current expenditure per pupil; (c) lowest, 1st decile, median 9th decile, and highest state averages of current expenditures per pupil; and (d) the same measures, adjusted to a constant dollar base. In line with the suggestions made below for fiscal indicators in higher education, a similar system of indicators could be worked out using states as the data base. This would follow the model of economic accounting, including the input of revenues, the output in expenditures, productivity indices in terms of graduates and pupil-years of education provided, and so on. Such accounts for each state for each year would provide the analytical basis for economic decisions, following the classical models of input-output analysis.

2.7 Number of school districts (computed using surveys of public elementary and secondary schools). There has been an interest in reorganizing school districts so as to reduce the number and achieve a more efficient administration. This goal was identified by the Gardner report in Goals for Americans (1960), but there still are some 16,200 school districts. An indicator of progress toward this goal should be monitored. The state-by-state adjustments in school district organization would

provide information on states that are contributing toward attainment of the goal. In addition, it is advisable to reassess the objective, to establish, for example, the optimal size for a school district. It may be that the large size of many school districts is inefficient.

### 3. Educational Organization: Higher Education (Part A)

Sources: Higher Education General Information Survey (HEGIS), Institutional Characteristics, and the Education Directory: Colleges and Universities (NCES, annual).

3.1 The number of higher education institutions, by type. The classification scheme published in the higher education directory consists of program types a through k (terminal-occupational through liberal arts and general with three or more professional schools) classified according to five degree levels (I through V, two years through other), categorizing all higher education institutions for the period of the report. In time series, such frequencies show the changing nature of educational organization. Such a display is illustrated, Figure 6.4, in Ferriss, Indicators of Trends in American Education (1969).

3.2 The change in higher education institutional type, by year. Metamorphoses of institutions from one type to another show adjustments made by institutions and reflect the consequence of influences, such as changing occupational demands within the economy, the impact of fiscal necessity, changing conceptions of appropriate educational arrangements, etc. Such a table requires a matrix showing the number of institutions by type over successive years. Insofar as is known, such a table has only been prepared for the period 1953 to 1954 with information from the fall enrollment surveys of those years by William A. Jaracz (Fall Enrollment in Higher Educational Institutions, USOE Cir. 419, Washington, D.C.: U.S. Government Printing Office, 1955). During the current and immediately forthcoming period of expected decline in enrollment in higher education, monitoring adjustments, deletions, etc. of the higher education establishment would be particularly useful, in view of the expected upturn later in

college enrollment ages of the population. This proposal would cross-tabulate the number of institutions by type from one year to the next following year, as illustrated by the following table (Table 1) from Jaracz. A more refined classification scheme would be desirable.

### 3.3 Changes in accreditation status, higher education institutions.

According to a recent issue of the Education Directory, "the best available method of ascertaining the general standing or quality of an institution of higher education in the United States is to examine its accredited status." Accrediting agencies include regional associations of colleges and schools, professional associations or special professional accrediting commissions, state departments of education, and state universities. This information is available from USOE publications or from each institution. Information also is available on institutions that are recognized candidates for accreditation. A measure is proposed for operating institutions, that is, institutions with students, by type, that are not accredited. Part of such a table might also show the number of non-accredited institutions last year that have since been accredited, and the number of accredited institutions last year that have lost accreditation, by type of institution. For the latter institutions, the former accrediting agency might also be indicated. In the interest of monitorship, characteristics of non-accredited institutions could be tabulated, including such information as size of student body, type of institution, public/private status, degrees offered, etc. Such annual data would be linked in time series.

## 4. Educational Organization: Higher Education (Part B)

Source: Fall Enrollment in Colleges and Universities (NCES, annual).

Enrollment by institution has been collected and published since 1939. Several student characteristics and a number of institutional characteristics are assembled (student characteristics: sex, full-/part-time status, undergraduate/graduate/professional status, freshman status, 10 fields of study, and ethnicity; institutional characteristics: public/private, university, other 4-year, 2-year, state where located). Because of the

Table 1  
Changes in Institutional Types 1953 to 1954,  
U.S. Higher Educational Institutions

|                                     | From 1953 |       |     | To 1954                                      |       |       |       |              | Deleted<br>and<br>Merged |
|-------------------------------------|-----------|-------|-----|----------------------------------------------|-------|-------|-------|--------------|--------------------------|
|                                     | Total     | Univ. | LAC | Separately Organized<br>Professional Schools |       |       |       | Jr.<br>Coll. |                          |
|                                     |           |       |     | Teachers                                     | Tech. | Theo. | Other |              |                          |
| Total                               |           | 141   | 723 | 193                                          | 48    | 114   | 125   | 513          |                          |
| Universities                        | 131       |       | 8   |                                              |       |       | 1     |              |                          |
| Liberal Arts Coll.                  | 713       | 13    |     | 1                                            | 1     |       |       |              | 8                        |
| Sep. Org. Profes-<br>sional Schools |           |       |     |                                              |       |       |       |              |                          |
| Teachers Coll.                      | 200       | 1     | 5   |                                              |       |       |       | 1            | 1                        |
| Tech. Schools                       | 53        | 5     |     |                                              |       |       | 1     |              | 1                        |
| Theo. Schools                       | 115       |       | 2   |                                              |       |       |       |              | 2                        |
| Other                               | 138       |       | 1   |                                              |       |       |       | 1            | 16                       |
| Junior Colleges                     | 521       |       | 10  |                                              |       | 1     |       |              | 9                        |
| Nonexistent (1953)                  |           |       | 7   |                                              | 1     | 2     | 3     | 10           |                          |

Source: Jaracz (1955), 10-11.

potential for linkage of the data with other characteristics of the institution, a number of additional traits may be added to the data for analysis. Each survey depicts the institutions, providing the static structure of higher education at one point in time. By linking survey to survey over time, the dynamics of changes in the institutional structure of higher education may be revealed. The problem is to identify significant characteristics for study and to generate statistical indicators that will uncover changes that may be taking place. Jaracz attempted to do this for changes in the types of institutions for 1953 to 1954 (see section 3.2). Transitions, however, must be examined over a long time period in order to detect routine changes, persistent changes, abrupt departures, etc. For this reason, time series are necessary. Changes in institutional type should be linked to parallel changes in enrollment by type.

A number of policy-relevant indicators might be generated from institutional data:

4.1 The changing support base of higher education, the predominant current change being a decline in privately-supported institutions and an increase in publicly supported ones, especially at some levels, e.g. 2-year colleges.

4.2 The persistence of predominantly black institutions.

4.3 The increase in coeducational institutions and the slight decrease in female-only colleges.

4.4 The vast increase in enrollment in 2-year colleges and in the numbers of 2-year colleges.

4.5 The decline in teachers colleges and the increase in liberal arts colleges.

While a number of other indicators might be mentioned, the point should be made that statistical indicators are not relevant until the empirical phenomena represent something of value to the polity, some

"concern." To maximize or minimize the indicator then becomes a policy issue, and the monitorship of the series becomes a significant agency function. Thus, the capability to generate statistical time series from archival data is needed, particularly at times when an issue arises that requires clarification. Once the issue has been identified, the next step in its analysis is the development of a model to enable the simulation of the system, the dependent variable being the social indicator that reflects the issue most directly. From the standpoint of public programming, it is important that the independent variables in the model be subject to influence by public action, primarily by investment of funds to stimulate the activity of some element in the system. For purposes of monitoring the system, a more refined institutional classification should be used, one similar to that employed in the Education Directory, including both type and level. With such a classification, time series should be developed for the number of institutions and the enrollment of those institutions.

4.6 Changes in enrollment by major field for institutional types.

4.7 Changes in enrollment by major field for ethnic groups.

4.8 Changes in enrollment by major field by sex.

A logical indicator of enrollment would be the percent of the population enrolled in the several types of higher educational institutions. This cannot be done for segments of the population defined by age because information on age of the enrolled population is not available in HEGIS. Ratios of enrollments to the size of age cohorts have been used, however, despite the uncertainty underlying such indicators. Table 2 illustrates the problem. While the ratio of NCES enrollments in higher education to the population 18-24 years old is almost identical with the ratio of Census enrollments in higher education to the same population base, the two nevertheless differ greatly from the actual enrollment rate for that age group. As a consequence, the expression of the enrollment data as a function of the population by age is not recommended.

Table 2  
Differences in Derived Ratios of Enrollment  
in Higher Education to Population

|                                | Males      | Females    |
|--------------------------------|------------|------------|
| a NCES Enrollment Survey, 1978 | 5,697,834  | 5,694,116  |
| Census CPS, Oct. 1978:         |            |            |
| b Enrollment, ages 14 and over | 5,580,000  | 5,559,000  |
| c Enrollment, 18-24            | 3,621,000  | 3,373,000  |
| d Population, 18-24            | 13,385,000 | 14,262,000 |
| Ratio, a/d                     | .426       | .399       |
| Ratio, b/d                     | .417       | .390       |
| Ratio, c/d                     | .270       | .236       |

## 5. Higher Education Faculty and Staff

Source: Salaries, Tenure, and Fringe Benefits of Full-Time Faculty and Employees in Higher Education (NCES, annual).

The survey reported here includes two major categories of information: number of faculty and staff and salaries of such personnel. The numbers of staff are classified by sex, four major categories of rank, and full- or part-time status. Faculty are classified by sex and by six levels of rank. Salary information is presented according to 65 positions for administrative personnel and according to six ranks for faculty. The amount of salary is reported by sex and level in \$500 intervals. In addition, there is information on expenditures for fringe benefits to personnel.

### 5.1 Salary by level or position.

5.2 The annual rate of change in median salary, by level or position, from the last reporting period to the current reporting period. To interpret this indicator, series are needed with which to compare it. The median salary of all family heads, the per capita gross national product, the per capita wages and salaries paid as compensation to employees in the national income account, or other such indices, expressed as the annual rate of change, might be used for comparison. As an example, the rate of change of median annual salaries of instructional staff in 4-year institutions is presented in Figure 1 and compared with the rate of change in the median income of family heads for the United States, for the period 1959 through 1973. Since the instructional staff data are in intervals of two years, the annual rate of change must be calculated using the compound interest formula. The comparison shows that only in the 1959 to 1961 period did instructional staff salaries do better than the income of all family heads, and that in two periods, instructional staff salaries fell markedly behind the rate of increase of all family heads, 1967 to 1969 and 1971 to 1973.

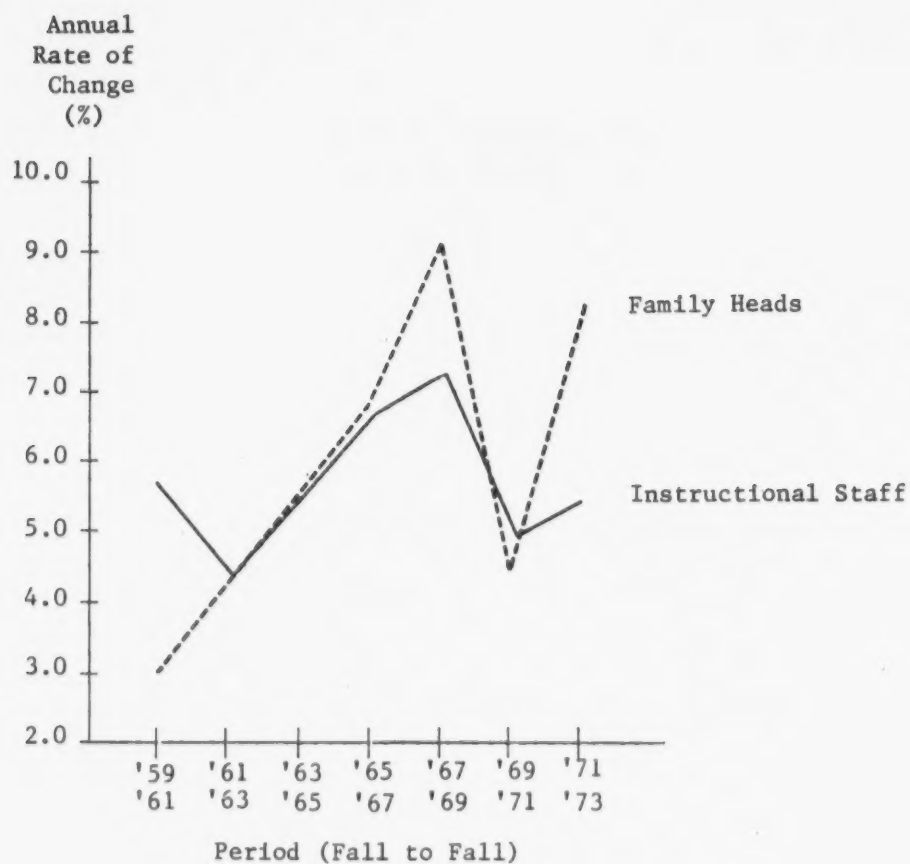


Figure 1. Rate of change of median annual salaries of instructional staff in four-year colleges and of family heads, United States, 1959-1973.

Actual salary comparisons may also be made when salaries of populations with equivalent education or experience can be identified. One source of such information is the NSF publication, Detailed Statistical Tables: Characteristics of Doctoral Scientists and Engineers in the United States. Inter-industry comparison of salary levels of holders of the doctorate would be particularly appropriate (federal government, business and industry, self-employed, employed in higher education). (As an example, see the ratio of the median annual salaries of Ph.D. scientists in educational institutions to Ph.D. scientists employed in other industries, Ferriss, Indicators of Trends in American Education, 1969, Table 8.5.)

5.3 Staffing and manpower indicators. While salary provides the basic incentive in higher education, forecasts of major changes in staffing requirements provide a useful tool for making adjustments in educational programs and policies. Models of the higher educational system provide the basis for such forecasts, a number of such models having been developed. The work of Bolt, Koltun, and Levine, Doctoral Feedback into Higher Education, Science, 1965, 14, 918-928, Cartter, The Supply and Demand of College Teachers, Journal of Human Resources, 1966, 1, 22-38, and Ferriss, Forecast of the Supply and Demand for Faculty in Higher Education to 1975-76, Trends in Postsecondary Education, OE-500063, USOE, 1970 illustrate these models. A long-standing deficiency of such models has been the need for information on transitions of higher education instructional staff from one state to another from year to year. Among the items of information that must be grossly estimated are the rate of retirement, the rate of mortality, the rate of transfer to employment in other industries, the rate of induction of foreign scholars into U.S. higher education, and so forth. Without adequate estimates of these parameters, such models of higher education manpower can only be minimally reliable. NCES's faculty survey, of course, is the primary source of such information.

Short of reliable estimates of the above-mentioned parameters, some internal comparisons may be made with the data. By "internal comparisons" is meant comparison of certain statistics between subsets of the data: male instructional staff with female instructional staff, instructional

staff in universities with those in other 4-year institutions, and so forth. To illustrate, changes in the frequencies by academic rank of men and women for 1974-75 and 1975-76 may be used to compute synthetic transition coefficients from level to level. (The term "synthetic" is used to acknowledge that the derived coefficients do not take into account the loss of personnel due to reasons such as retirement, death, and transfer to other professions.) The comparison shows the differential rates of mobility for the two (Table 3). The rate of progression of males up the academic ladder exceeded that of females in the two top ranks, but females exceeded males in progression from instructor to assistant professor. Such transition coefficients should be linked in time series for annually assembled data. These data may also be used to estimate the rate of expansion in new instructors by dividing the increase in numbers of instructors at a particular faculty rank by the number of instructors at this rank in the base year. (Such derived measures assume that an adequate supply of instructors is available.)

#### 6. Financial Statistics, Higher Education

Source: Financial Statistics of Colleges and Universities (NCES, annual).

This annual survey shows the revenues and expenditures of institutions of higher education, indebtedness on physical plant, and the endowment of the institutions. Data on revenue provide the basis for fiscal indicators of the support base of higher education institutions. The relative contribution of the several sources to aggregate revenue are important indicators of the support base. These are most simply expressed as the percentage of total revenue. They show the relative decline in endowment earnings, auxiliary enterprise earnings, private gifts, etc., and the increase in income from government sources, etc. Disaggregation of the governmental contribution shows the widely-swinging contribution of the federal government and state governments and the fairly steady support of local government.

Table 3

Synthetic Transition Coefficients by Level for Men and Women,  
Full-Time, Instructional Faculty on Nine- and Ten-Month Contracts  
in Higher Education, Fall 1974 and Fall 1975, U.S.\*

|                               | Men  | Women | Ratio W/M |
|-------------------------------|------|-------|-----------|
| Assoc. Prof. to Prof.         | .243 | .098  | 0.40      |
| Assist. Prof. to Assoc. Prof. | .156 | .083  | 0.53      |
| Instr. to Assist. Prof.       | .137 | .160  | 1.17      |

\* Source: The Condition of Education, 1975, Table 63, p. 87 and  
The Condition of Education, 1976, Table 6.12, p. 252.

Synthetic transition coefficients were obtained by dividing the total increase in the number of persons at a particular faculty rank by the total number of persons at the next lower faculty rank during the preceding year. For example, the rate of upward mobility for males who were associate professors in 1974-75 was computed in the following way:

Increase in the number of male professors from 1974-75 to 1975-76 (58,874 - 47,087 = 11,787) divided by the number of associate professors in 1974-75 (48,456) equals the transition coefficient .243.

Expenditure data have been subject to study by an economist, D. Kent Halstead (e.g., in Halstead, Higher Education Prices and Price Indexes, DHEW Pub. No. DE 75-17005, Washington, D.C.: U.S. Government Printing Office, 1975). His publication identifies a number of indices of expenditure that enable assessment of higher education expenditures in relation to those of other segments of the economy. As such, his work provides the basis for an annual updating of the time series in his publication. In addition, there are certain aggregate expenditures that lend themselves to expression on a per student, per faculty member, or per institution basis. Among these are:

- 6.1 Education and general expenditures per FTE student.
- 6.2 Expenditures on instruction and departmental research per FTE student.
- 6.3 Expenditures on research per faculty member.
- 6.4 Expenditures for plant operation and maintenance per institution.
- 6.5 Expenditures for organized activities related to instructional departments per institution.
- 6.6 Extension and public service expenditures per institution.
- 6.7 Library expenditures per institution.
- 6.8 Administrative and general expenditures per institution.
- 6.9 Auxiliary enterprises and student aid expenditures per institution.

The framework that is needed would enable the analysis of the input of fiscal resources and the expenditures of revenues in relation to the quality of the institutional product--the quality of the degrees produced. Since the data are not released by institution, such an approach would be

possible only on an analytical level, and the published results could not identify institutions. However, even this approach must await the development of an adequate criterion of institutional quality (e.g., to assign weights to degrees produced by an institution). This framework could lead to identifying administrative and educational practices that produce a better product per unit of expenditure and thus would provide models for institutions to emulate.

Within institutions, a great deal of effort has been devoted to the analysis of per-student expenditures by field of study, in efforts to monitor and control expenditures. This work has been initiated by state boards of control of higher education, notably in Florida and Arizona. It is a contribution to the general subject, of concern to administrators and agencies that support higher education, of the costs of educating a student.

#### 7. Graduates of Higher Education

Source: Postsecondary Education, Earned Degrees Conferred.

Two potential uses of these data are to reflect the quantitative functioning of the educational system and the qualitative functioning of the system. Data on degrees have been extensively used to reflect the former, but the use of degrees to evaluate quality of the system has not been developed.

Indicators of quantity may be developed as ratios of input to output of the system, using degrees as output divided by the input of students at an earlier point in time. The generally uniform grading of the educational system makes this possible, it being a system of at least 13 levels of "output" each of which may be considered "input" to the next higher level. The assumption is that the output from one level continues schooling into the next level and completes the course of study without interruption. A statistical time series computed annually upon the basis of the same assumption will reveal information on the system, as illustrated by the following. Baccalaureate degrees granted by higher education institutions

per 100 high school graduates four years earlier reveals significant transformations in American education. During the 1890s, some 50 of 100 high school graduates completed college four years later. This ratio declined steadily until just prior to 1920, owing to the impact of increasing secondary school graduates. With college-going stimulated during the 1920s, the index increased, only to fall during the 1930s under the impact of the depression and up through the mid-1940s, during World War II. The index peaked at about 40 per 100 in 1950, when war veterans were graduating. It has been in the 30 per 100 range during the 1970s. For a graph of the trend see Ferriss, Indicators of Trends in American Education (1969, p. 10).

Such indicators measure an aspect of the "efficiency" of the educational system. A number of indicators of this kind may be suggested, as is shown by the following descriptions.

7.1 The ratio of college baccalaureates to high school graduates four years earlier, total, for males, for females. (Ferriss, 1969, p. 110.)

7.2 The ratio of baccalaureates to first-time entering enrollment four years earlier, total, for males, for females. (Ferriss, 1969, p. 113.)

7.3 The number of Master's degrees divided by the number of baccalaureates two years earlier, total, for males, for females. This statistic may also be computed for broad fields of study. (Ferriss, 1969, p. 124.)

7.4 The number of doctoral degrees divided by the number of baccalaureate degrees "x" years earlier, total, for males, for females. "X" is the average years required by field to complete the doctorate after the baccalaureate is awarded, as determined by the National Research Council annual survey of doctorate recipients. (Ferriss, 1969, p. 124.)

Turning, now, to quality of the degree output, a basis is needed for assigning a weight to the degree produced by the institution, so that for each year a statement may be made of the number of degrees by levels of quality. Three solutions have been suggested for this problem (Ferriss, 1969, pp. 159-160): (a) degrees by GPA, with institutional weights for GPA being established periodically by some evaluation procedure, calculated by field; (b) degrees from qualitatively assessed institutional programs, as is done by Chemistry for B.S. in Chemistry, requiring program certification by field; and (c) degrees from qualitative assessment of institutions, the evaluation being based upon institutional evaluation by field, as was done by Carter (1966) and others, periodic assessments being necessary. Since the determination of an appropriate method of assessment is required through experimenting with various techniques that require gathering new data, no recommendations are made here.

8. Plan for Developing a Research Unit on Educational Indicators within NCES

Consideration of the development of units of work on social indicators of education that utilize specific analytical skills and computer resources is presented below in relation to various data assembly and analysis tasks.

8.1 Assembly of basic indicators. NCES has inherited data on U.S. education beginning with the 1870 report of the Commissioner of Education, chiefly in published reports but also in work tables, in files, and on computer tape. A primary, essential, and preliminary task in the development of social indicators of education is the ordering of these data so as to achieve consistent reporting across time, annotated as to sources, changes in data-collection concepts, definitions, practices, geographic coverage, nonresponse rates, and other such factors that may influence the results. This information should be as exhaustive as available records permit, and it should be supplemented by incidental information in the memory of persons who have had responsibility for some of the work in the past. Much assembly work has already been done. It should be checked against original sources and "certified," so to speak, as the most accurate estimate of the statistic that is possible from the information now

available. Sources of some of the work already done are: Digest of Educational Statistics (NCES, annual), The Condition of Education (NCES, annual), Science Indicators (NSF, periodic), Selected Statistics Prepared for Woods Hole Meeting of the President's Science Advisory Committee Panel on Scientific and Technological Manpower, July 1-8, 1962 (NSF-SRPO), Indicators of Trends in American Education (Ferriss, 1969), Education of the American Population (Folger & Nam), Historical Statistics of the United States, Colonial Times to 1970 (Census Bureau, 1975), and others.

The product of this work should be: (a) preliminary reports issued as the work proceeds and is completed presenting the time-series data and annotations, without interpretation (the purpose of such preliminary publications would be to place the data in the hands of investigators); (b) computer tapes of the data in related sets or topics, along with codebooks that also contain annotations on the data; (c) a comprehensive volume, comparable to Historical Statistics of the United States, presenting in permanent form the data previously issued in preliminary reports; and (d), periodic updating of the series in a form comparable to Economic Indicators, but issued annually. Time series of variables exogenous to the educational system but influencing it should also be included in this volume.

Personnel to accomplish tasks such as those set forth above would be those who initiate and carry out the currently routine data-gathering work of the NCES. However, some training would be required in the standards set for the review and "certification" of the historical data and other criteria for the work.

8.2 Development of models. The utility in analysis, decisionmaking, planning, etc. of the data assembled under unit 1, above, depends upon the development of analytical models that incorporate the data into an interactive system relative to some outcome or criterion. This unit of work would begin by assembling models of sectors and aspects of the educational system that have been developed. (A preliminary, partial list of such models is presented in the Annals, 1978, 433, pp. 169-170, in my article, "Trends in Education and Training." Note, also, the OECD publication,

Mathematical Models for the Education Sector, 1973.) An assessment of these models should be made from the standpoint of the reliability of the estimates derived therefrom and the utility of the criterion of the model for policy purposes. Experimental models should then be developed in an attempt to identify additional models that produce reliable and policy-relevant results.

Personnel for this work require a high degree of sensitivity to interactions among variables within the educational system. Consequently, persons competent in model building, knowledgeable in the subject matter of education, and experienced in assessing indicators should be inducted into such a program. All such persons need not be permanent personnel of an NCES educational indicators program unit; indeed, such persons may most readily be located in academic or research centers. The output of this model building should be reported in NCES publications, irregularly as the results accrue, in scientific journals, and in connection with analysis of social indicators of education, however distributed.

8.3 Testing of macro dynamic structural equation models. Following the lead of economic time-series analysis, the statistical analysis of relationships between independent time-series variables and a dependent (criterion) variable has come to be recognized as a productive approach in social indicators research, largely through the efforts of K. Land. This approach has already been applied to educational data (e.g., in Felson, M. & Land, K. A Dynamic Macro Social Indicator Model of Changes in Educational Enrollments, Attainments, and Organizations in the United States: 1947-74. Urbana, IL: University of Illinois, Department of Sociology and Social Science Quantitative Laboratory, 1976).

This work should proceed by selecting criterion indicators that are highly relevant to policy issues, current or potential. Independent variables should be selected that are subject to some kind of manipulation by public programs, provided such variables are demonstratively related to the criterion. (In some instances, the cause-effect relationship between the independent and dependent variables may need to be established through field experiments.) Dependent variables selected should be as specific as

the data allow (e.g., not merely enrollment, but enrollment of a particular age, sex, race category), and they should be selected because of their relevance to some current problem or policy issue and their relevance to some theory of the functioning of the educational process.

Once a regression equation is satisfactorily established, it may be used in two ways. First, it may be used experimentally by assuming a change of various magnitudes in the independent variables to assess the consequences of such changes to the dependent variable. Such experimental manipulation should be accompanied by policy considerations of appropriate programs of intervention that might practically be instituted to alter the magnitude of some of the independent variables. Such policy considerations should be posed by a council of educational advisors, to emulate terminology of the Council of Economic Advisors, except that the advice at this point is not intended for the President, but rather for the Secretary of the Department of Education. Should specific program recommendations result from this step, the next phase of such work should pass out of the educational indicators program unit to a more specialized program and evaluation unit, which would experimentally field test the validity of the model for effecting the predicted change in the criterion. Only after the validity of the model is established experimentally should the program be proposed for implementation.

The second use of the equation would be to place it within a system of equations that comprise the educational system. For example, one equation might predict the input of students into the system, based upon assumptions about the married rate, the fertility rate, the enrollment rate, and other relevant independent variables. This input equation would be placed within the system of other equations which predict (a) the distribution of students by subject, (b) the distribution of graduates by subject, (c) the distribution of first post-school jobs by specialization, and so forth. In short, interactive equations could be developed which would simulate the functioning of major segments of the educational system.

Personnel for this work should be trained in the statistical analysis of time series, in substantive aspects of the educational process, and so

forth. The unit should have the capability of calling upon occasional specialists for advice and consultation.

8.4 Experimental indicators. Consideration must be given to identifying new indicators that are needed in time series. Some of these may already have been developed but are not collected periodically. Educational research should be reviewed to identify understandings of the educational process that scholars have established, perhaps upon the basis of single-time, cross-sectional studies, path analysis, experimental studies of relationships within the classroom, etc. Instrument development on small samples should be part of this work. Preliminary trials should be instituted to determine costs of data collection, feasibility in relation to other alternatives, etc. The end results of such work should be the specification of the data-assembly procedures for collecting new indicators on a routine, periodic basis. Personnel for such work will require a variety of skills in instrument development, sensitivity to the impact of data requests upon school/educational personnel, and experience in statistical analysis.